REFINER
AND NATURAL GASOLINE MANUFACTURER

JULY, 1935
Vol. 14, No. 7

A Gulf Publishing Company Publication
EDITED MONTHLY AT HOUSTON, TEXAS

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GEORGE REID
Editor

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SPECIALIZED OIL JOURNALS

Published by

GULF PUBLISHING COMPANY

OFFICE OF PUBLICATION
3301 Buffalo Drive, Houston, Texas

R. L. DUDLEY, *President*
A. L. BURNS, *Gen'l Manager*
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LOS ANGELES: 416 Haas Building, W. E. Green, Manager.

TULSA: 1020 Hunt Building, J. F. Carter, Jr., Manager.

FORT WORTH: 203 W. T. Waggoner Building, H. H. King, Manager.

Single copies 20 cents. Domestic and Foreign subscription price, $1.00 a year. Entered as second class matter June 16, 1923, at the post office at Houston, Texas, under Act of March 3, 1879. Advertising rates on application.

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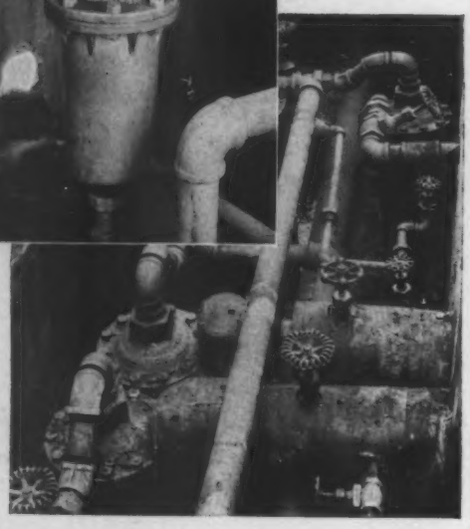

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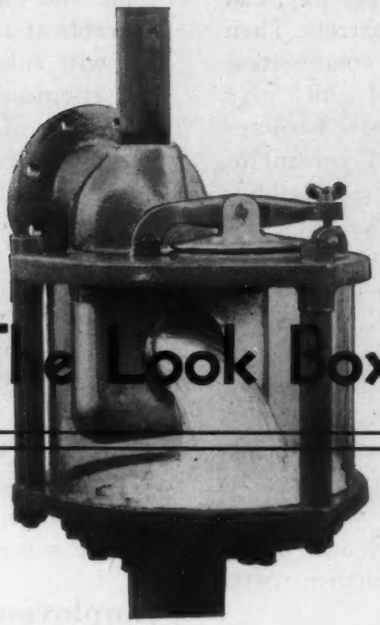


The Look Box

AN economist, some say, is a "fellow that figures things out." The usual type of economics taught during college days proves of little practical value during plant operation days.

Economic Engineering

Business economics for engineers and chemical engineers may be of some aid to thinking, but of doubtful value in making processes perform.

Shouldn't there be more "engineering economics" taught and its practical application demonstrated so that engineers entering industry can take dollars and cents and product and processes and make intelligent analyses to derive profits?

The chemical engineer in industry without a knowledge of engineering economics as well as economical engineering, often has hard sledding. Economic systems are fine in their place, but the application of economic system or theory to every day engineering and operation problems doesn't work out.

An engineering economist that applies his engineering knowledge to the economics of unit operation is that much ahead of the engineer and/or the economist—and this is the combination that industry is looking for and needs. Always has. Always will. He is the "fellow that figures things out and makes them work—at a profit."

TECHNOLOGISTS within the industry generally agree that shell stills are obsolete—yet a drive from coast to coast this year involving viewing about 100 refineries, brings about nothing short of amazement at the numbers of shell still batteries still doing service. And that causes a little digging into the statistics of the industry with the result that the conclusion is reached that somewhere between 27 and 40 percent of all crude processed by the industry, is processed through shell stills.

Still Shell Stills

According to the Bureau of Mines in its annual list of refineries and refining facilities, on January 1 of this year there were 418 pipe stills in crude oil service with total rated charging capacity of 1,907,360 barrels per day. Subtract this from the total operating capacity as of that date, which was 3,553,569 barrels, and the result is 1,646,209 barrels crude oil charging capacity which is not pipe stills. Then estimate from the records as closely as possible, and get a liberal estimate for capacity of "combination" units to which crude is charged, and that figure will be approximately 200,000 barrels, and it's probably fairly liberal. Subtract that from the 1,646,209 and the answer is 1,446,209 barrels not charged through pipe stills. So the answer is approximately 40 percent of the operating capacity is

represented by shell still batteries. That is one route and one figure.

Try another this way. Take the total capacity (operating, shut down, and building) as of January 1, 1935, a total of 3,962,667 barrels, and subtract therefrom the total capacity of all pipe stills (crude service, other oils, shut down and building) which is 2,950,414 barrels per day, and the answer to that one is 1,012,253 barrels. Then subtract that liberal estimate for combination units taking crude as the charge, and which may not be reported as such, and the answer becomes 812,253 barrels per day, or about 27 percent of total capacity represented as not pipe stills—but must be shell stills.

There have been many "guestimators" announcing the conclusion that the distillation facilities of the industry were around 30 percent obsolete—and the shell still situation tends to confirm those opinions, and without including anything of the number of old, worn out, badly designed and inoperative pipe stills. There are plenty of them still doing service after 12 to 15 years of improvement in designs, while their owners continue to take a beating because of inefficient operation and high maintenance costs.

Transition To Big Ones

THIS industry has always been, and always will be in a condition of transition from one progressive step to another. Distillation started out in the refining of petroleum with only a pot and a worm to guide it. Then came the cheesebox idea, then the cylindrical horizontal tank — termed shell still. Technologists hooked them up in batteries and costs went down. The fractionating tower appeared in swaddling clothes, and better efficiencies were reported. Then a pipe still got tied into the shell still battery and increased through-put with better economy. Later technologists convinced management that the pipe still was all that was needed, along with heat exchanger, fractionation and condenser coils.

All of the pots and worms are gone. The cheese box is a relic occasionally preserved on some plant yards as sort of historical markers or perhaps purely out of sentiment. The shell still operating alone is getting very rare. The shell still battery still functions in many more yards than is generally realized and to the extent that its transitory movement out the back way to the scrap heap, although confidently expected for several years, may yet be delayed another several years, unless some real profits show up on managements' books. But the period of transition from shell to tube still should have passed—and with better times will pass much quicker than the trend has been during the past four years.

The period of transition now affecting the industry, in distillation, is that between tube stills for distillation and tube stills for cracking and combination skimming-cracking and reforming units, or refineries all in one piece. They have come and have done well, and in finding them operable at 15 cents per barrel or less, the industry will enlarge upon their use. Technologists and engineers now looking forward to the ultimate time of ownership of such units are argueing as to whether they shall be big, charging up into the thousands of barrels per day, or shall the refinery consist of two or more smaller combination units — complete refineries in themselves. A thought is—that when a little thing goes wrong with a big one, and a big one shuts down, the whole plant is shut down. That is, the bigger they are, the more costly.

Employment and Wages

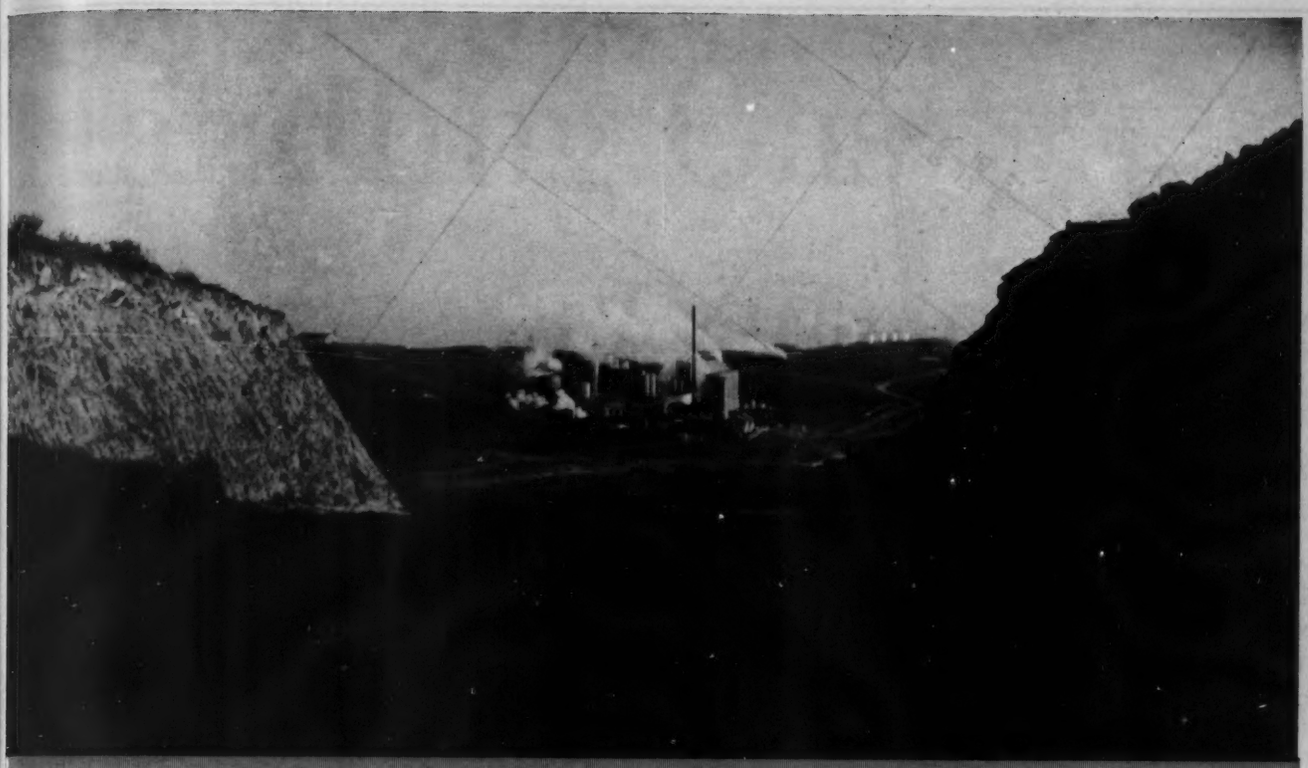
EMPLOYMENT and wages in the American petroleum industry generally are ahead of those in any other manufacturing enterprise of comparable importance, and exceed even the levels of 1929, it is indicated in a U. S. Bureau of Labor survey reviewed by the American Petroleum Institute. The survey covered employment and wages in drilling and production, pipe line operation, and refining.

Using May, 1929, hourly wages as the base 100, the survey revealed that in July, 1934, wages for drilling and production had reached the index 118, for pipe line operation 144, and for refining 117. Drilling and production employes were working 34 hours a week, and refinery and pipe line transportation employes 35 hours a week.

Despite the 33 1/3 percent decline in working hours, pay was reduced only 21.1 percent in drilling and production operations, 14.9 percent in refining, and one percent in pipe line transportation. Operating employes in these three branches of the industry averaged about $27 per week. The Bureau, explaining that the cost of living had declined approximately 20 percent during the same period, declared these employes "were receiving a real income not less than that received in 1929 despite the reduction in the number of hours worked."

The industry contributed substantially to the policy of spreading work, the survey pointed out, with the index of employment rising from 51 in May, 1933, to 83 in July, 1934. The index of total man hours in the producing branch advanced from 45 in May, 1933, to 55 in July, 1934, with employment increasing five times faster than total man hours in refining and nearly 10 times faster in pipe line transportation.

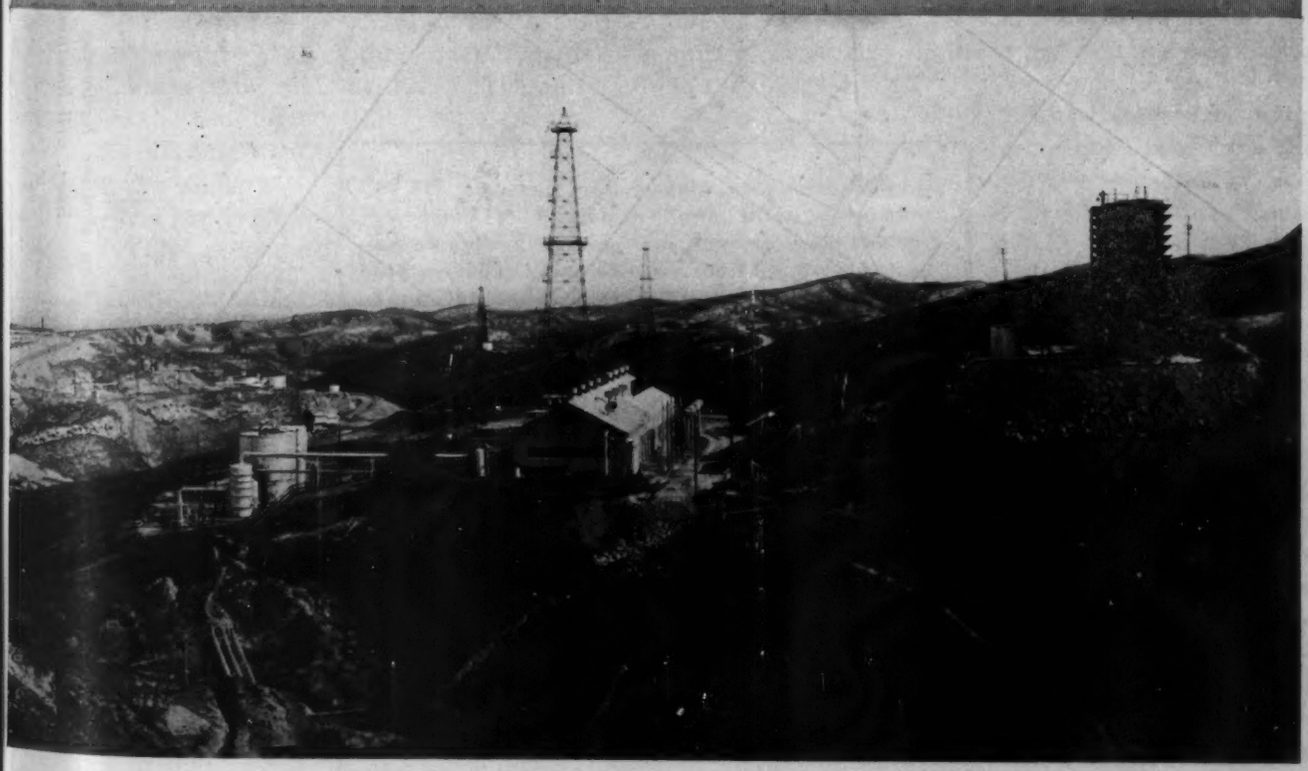
(*Continued on page 37a*)



Western States Gasoline Corporation's natural gasoline plant at Kettleman Hills.

California Development Number

Kettleman North Dome Association Gas Booster Station No. 28-J.



Map showing Kettleman North Dome Association activities, including gas gathering lines, well location, booster plants, mixing stations and gasoline plants.

Handling Gas at Kettleman Hills

J. C. ALBRIGHT

WELLS in the northwest end of Kettleman Hills North Dome are down the flank of the structure and the northwest nose, particularly those in and around Section 29-J, produce gas and oil from two lower zones, designated the "black sand." Section 29-J is more accurately described as Section 29-21-17, the latter affixed being a designation of the township, and used for convenience of the producing agencies and others interested. Because of the absence of the high gravity oil in that area, the lines are a single system and are called the "black sand" lines.

Farther towards the center and crest of the dome, where the contours show that the Temblor sand is much nearer to the surface, wells have wider spacing. Oil produced from these wells comes from the upper three zones and is of high gravity with a much larger gas-oil ratio. This gas is transported through another system of lines which are termed the "white sand" gas lines. Each of the two systems are subdivided into three others, one of which carries the gas coming from the intermediate oil and gas separators and the other handles the gas and vapors removed from the flow tank batteries. The third in each series is the high pressure line leading from the wells, the high pressure traps and the booster stations. The pressure carried on the high pressure line is around 475 pounds, or sufficient to deliver the gas to the gasoline plants so they may operate at or near 450 pounds on the absorbers. The intermediate line is carried at about 125 pounds, while the low pressure, or vacuum lines have a presure of approximately atmosphere.

Gas production difficulties are magnified and complex due to the conservation program in effect at Kettleman Hills. Oil production is allocated regularly, but the volume of gas produced depends upon the carrying capacity of the transmission lines, and the demand for fuel at the terminals. Markets for both domestic and industrial fuel varies from day to day, running to peak loads during cool weather, and falling off when the temperature rises, and particularly so on week ends and holidays if the weather is warm. These conditions place a restriction upon the amount of gas produced and complicate the operation of the field, but, fortunately for the operators of the gas gathering, transportation, and distribution system in Kettleman Hills, the two kinds of gases are available, the white sand gas on the crest of the structure, and the black sand gas lower down in the Temblor. The volume of gas produced from the wells in the lower section of the productive formation is practically constant. This type of gas comes in steadily to the gathering system, and during the warmer months and periods of low industrial activities, constitutes the major portion of the fuel transported by the four utility companies who have gas systems originating in the field.

THE gathering lines handling the wet gas produced by Kettleman North Dome association are described, showing that three separate systems are necessary. One to carry the high pressure gas from the traps directly to the gasoline plants, while gas under a lower pressure must be compressed. Vapors arising from oil in storage tanks and flow tank batteries are removed under a pressure of atmosphere, or slightly below, compressed and fed to the intermediate, and high pressure lines for transportation.

Compressor plants are described, as well as the facilities for maintenance. Drips and pipe line condensate equipment are described in detail, showing the construction, method of installing, and method of removing the condensate from the lines and from the drips. It is shown also that the last stage of compression used in the field boosters is not cooled so that the gas will travel in the field lines hot in order that less condensate will collect in the lines.

The system of gas gathering lines runs from the southwest corner of Section 8-22-17, Kings County, to Sections 20-J and 30-J-20 and 30-21-17—in Fresno County, about 7½ miles from one end to the other. Included in this system is a separate series of pipe lines which carry the pipe line condensate, or drips. They parallel the high pressure mains throughout the field. As the most actively produced areas in the North Dome are centered in and around Sections 1 and 2-P and 35 and 36-J,

Kettleman North Dome Association gas booster station 30-J.

known as the Felix area, and Sections 19, 20, 21, 28, 29 and 32-J, known as the Huffman area, the system of gathering lines branches out into numerous laterals. Because several quarter sections in the Huffman area have been drilled to the maximum number of wells permitted, by companies operating outside Kettleman North Dome Association, it was necessary for the association to loop Section 29-J with a low pressure system and mains carrying gas at the intermediate pressure of 125 pounds. As an auxiliary system, vacuum lines were laid across the east and west sides of this section to carry vapors from the flow tank batteries removed by the field booster stations.

Two booster stations handle the gas produced from wells drilled on adjoining sections, and from tank batteries set to receive the oil. One of these stations is located in the northwest corner of Section 28-J, and the other in the southeast corner of Section 30-J. Both are equipped with seven units each, consisting of gas engine-driven compressors. The booster station in Section 28-J has two units equipped for handling tank vapors from a pressure of slightly below atmosphere on the intake to 50 pounds at the discharge. Five of the units receive the gas from the low pressure units and the gas from the intermediate lines and boost it to the transmission line pressure of 475 pounds. The booster station in Section 30-J also is equipped so that two units are operated to remove the tank vapors at a pressure at or near atmosphere, boosting them to 125 pounds, while the remaining five units receive the intermediate gas and discharged vapors from the two low pressure units, and boost the combined volume to the line pressure of 475 pounds.

The interstage compression vapors and gases are cooled after the first compression before the high pressure units receive them, but the final, or 475-pound compression delivers the gases hot to the intake of the transmission lines. Of two other stations, one in Section 34-J has only one compressor, the other, in Section 2-P, has seven units, operated similarly to the station Section 30-J. All of the stations are complete within themselves, being operated by separate engineers and operators. Engine and louvre tower water is cooled in a more or less standardized manner, pumping the water from the pits and louvre tower basins over the top and depending upon evaporation to reduce the temperature.

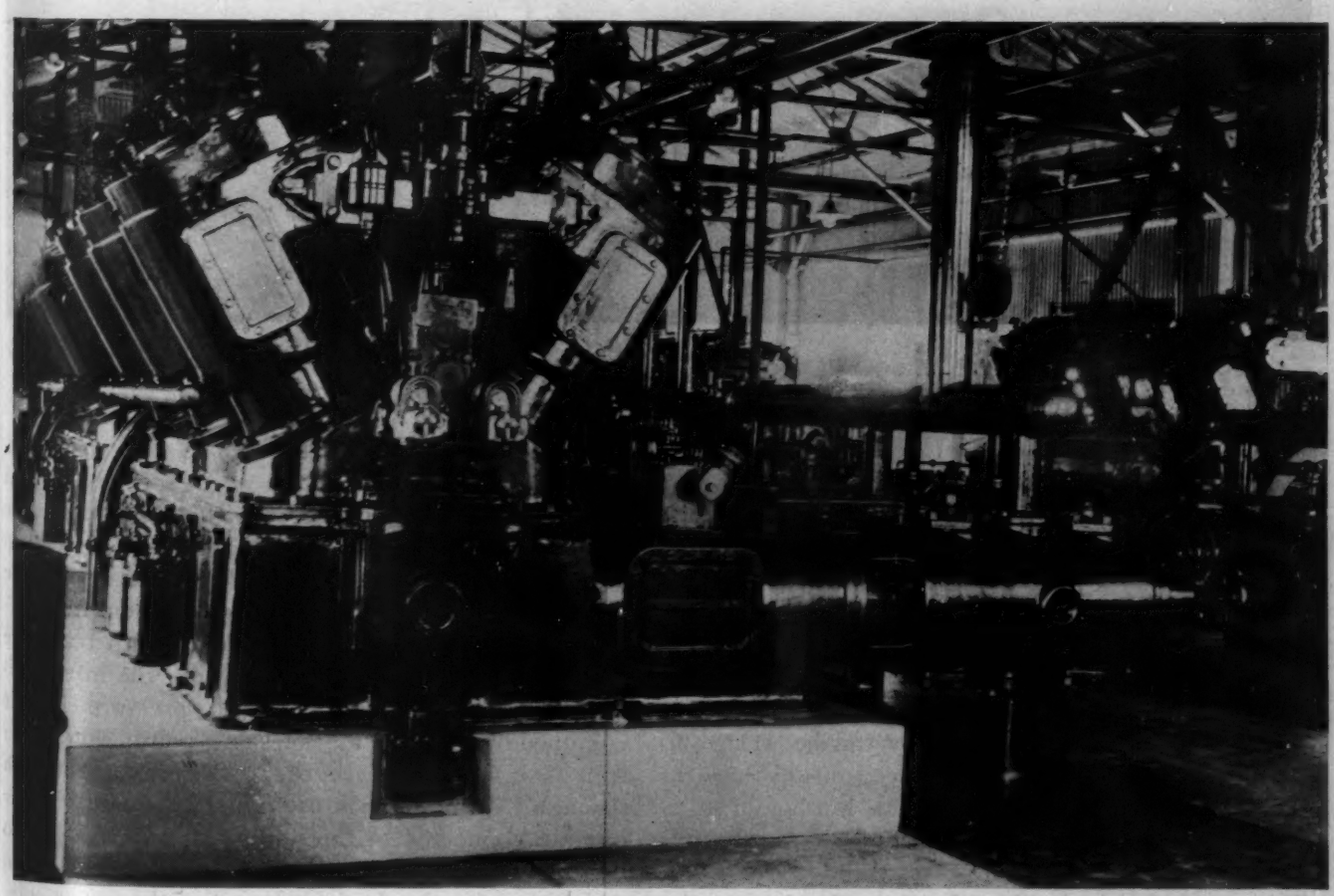
All of the pumps that handle both jacket and cooling tower water are driven by separate gas engines, some of which are horizontal units belted to a line shaft in the regular manner, while others, particularly Booster 30-J, has direct-driven centrifugal pumps attached to vertical multi-cylindered gas engines. This station also is equipped to handle the gas by the installation of vertical V type six cylindered gas engines with the compressor connecting rods attached to a common crank shaft. Efficiently designed cooling towers must be used in Kettleman Hills, and they are usually arranged so that the prevailing winds can blow through from one side to the other. Winds ordinarily are light to variable but occasionally stiff gales occur which cause considerable wind losses if the louvre towers are not designed to prevent.

All of the stations are equipped with labor saving units, such as pressure drums which contain the lubricating oil, hoists with which to handle the heavier parts and tools with which to maintain the equipment. The combined capacity of the four field booster stations is about 32,000,000 cubic feet of gas, vapor, low pressure gas, and gas boosted to 475 pounds line pressure.

To more easily show the magnitude of Kettleman Hills as far as the gas situation is concerned, approximately 12,673,000,000 cubic feet of gas was produced in January, 1935. Of this amount, Kettleman North Dome Association wells produced about 43 percent, while Standard Oil Company of California produced a like volume. The remaining 16 percent was produced by companies operating wells outside the association organization. During this time, approximately 10,000,000 cubic feet of fuel was required for drilling wells, gasoline plant power and other uses in the field. The remaining 12,663,000,000 cubic feet was transported out of the field through the high pressure transmission lines of four utility companies.

Separating the gas from the oil and measuring it is a man sized job in itself. Each well must be accurately metered, especially when only one well is producing from a separate section, or subdivision of land because the most of the leases of the association are U. S. government permits. Sometimes a well flows directly to its individual separator and the oil and gas metered through separate instruments in order to obtain the exact amount. Then both are mixed in a common lead line running from this well to the flow tank battery. The gas and oil are passed through traps to again separate the oil from the gas, and the oil travels to the tanks, while the gas enters the gathering lines. If it comes from wells having sufficient flowing pressure, the gas is placed in the high pressure mains, but if the pressure should be below 475 pounds, it is classified as intermediate gas and enters the suction lines leading to one of the four compressor plants. When several wells are producing from an individual lease, all of the production, both oil and gas, flows to a central trap setting where the oil passes through two systems, the first the high pressure, and the second being the intermediate system. Gas is metered from this trap setting and passes ultimately through a master meter if handled by a field booster station, when again it is measured before entering the lines leading to the gasoline plants.

The gas separated from the "black sand" oil usually has a high temperature, while that produced from wells on the top of the structure is much cooler. The temperature before expanding the gas and oil through the flow beans at the Christmas trees is about 160°F. at the northwest end of the field; 150°F. in the south end, while the temperature of the production coming from the top zone is only 135°F. If



Interior Kettleman North Dome Association gas booster plant 30-J. "V" type engines driving horizontal compressors.

a well has a tubing pressure sufficiently high that it can easily enter the high pressure gas lines, the temperature is cooler than that from a well which only has sufficient pressure to maintain its allowable and still high enough to place the separated gas into the gas gathering system. Because of this, the gas entering the compressor stations necessitates cooling between stages. Because of the high temperature, the gas is transmitted as warm as possible to prevent formation of pipe line condensate.

Notwithstanding the high temperature of the gas as it enters the transmission lines, the association produced approximately 20,000 gallons of drips each day during the winter. This amount of fluid presents its difficulties and subtracts from the efficiency of each pipe line in which it accumulates. Several types of pipe line drips have been tried and others designed, but only two types have been installed generally. One type is the horizontal drum attached to the under side of the pipe line by two connections.

Another drip which has been designed is similar to the last one described, but having pipe line returns leading from a point down stream on the under side of the pipe line, and connecting back to the drip at the lowest point. This type of drip has been given considerable thought, because of the tendency of the heavier hydrocarbons to condense after the gas has passed through the pipe line drip. When this happens, and it occurs often in this field, the liquid will not travel over the hills and higher points with the gas, but returns down the slant of the pipe, up stream against the gas. The velocity of the gas is usually such that it prevents the fluid from flowing back to a point where it will enter the drip, and consequently prevents the lines from carrying the desired amount of gas.

Throughout the longer sections of the pipe line system, as between the northwest end and the central location, the low pressure, or 125-pound line parallels the high pressure line. The condensate line carrying the pipe line drips is covered in the same ditch, or follows closely beside the two gas lines so that the drips may be emptied into the condensate line when necessary. Mechanical means are provided to blow these drips, but line walkers pass over the lines at regular intervals to maintain them in working condition. About 75 automatic dump traps are used to blow these drips. When both the intermediate pressure line and the high pressure line is equipped with drips at the same point, a common trap is used to remove the condensate from both through a common hook-up. The low pressure one is directly connected to the dump trap and is open to its chamber when the trap is in a closed position, which permits the fluid to flow directly to the trap. Through another system of fluid lines, the lower part

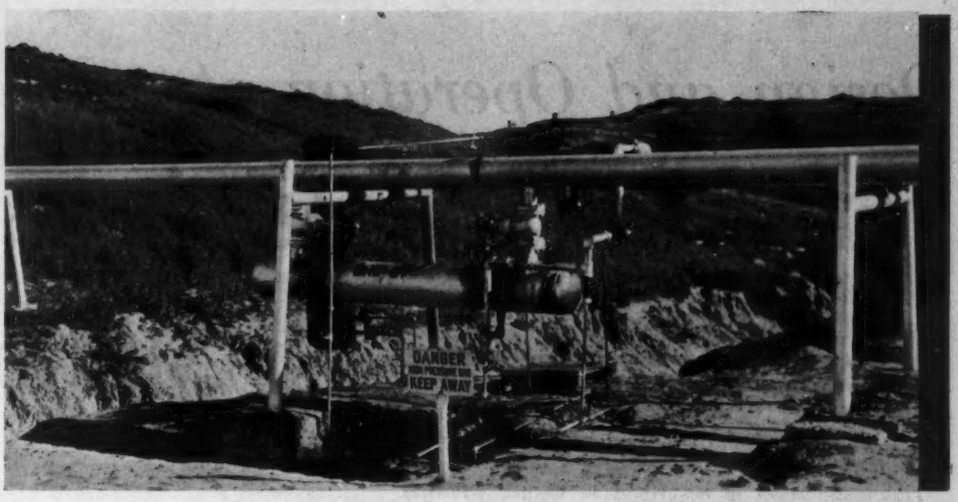
Meter setting at point where gas is metered into booster station 30-J.

Each drum is about 10 feet long (varying as to the size of the pipe) and is placed on the line at its lowest point where it crosses the canyons and draws in the field. By connecting it at two points, it is not necessary to install an equalizer line, as is the case where the drip is fastened at one end only.

The other type drip is a vertical drum, made of pipe considerably larger than the line, and about six feet long. It is made with two connections, each the same size as the pipe line in which it is to be set. They are welded to the drip on opposite sides and are made of short nipples so they can be welded to the line in place. A baffle is placed inside the drip to deflect the line of flow from a horizontal to a vertical and back again so the condensate may fall out of the gas stream as it passes through the drum. This type of drip is also placed in the line at the point of greatest dip when crossing depressions.

of the high pressure drip is connected in such a manner that when it is directly connected to the trap, the low pressure drip is disconnected.

As the trap fills with the liquid from the low pressure drip and begins to operate, the valves are closed on the pipe coming from the low pressure line, and at the same time, the line from the high pressure drip is opened. This action admits high pressure fluid into the dump trap chamber which maintains an open line to the condensate pipe line as long as fluid is to be removed from the drip. This action repeats itself each time the low pressure drip fills the chamber of the dump trap, but if no fluid is to be removed from the high presure drip, the gas pressure moves the condensate from the trap. This system of requiring the high pressure drips to furnish the power to blow the condensate into the collecting lines has proven very satisfactory, and requires a minimum of attention from the line walkers in keeping the packed joints which are a part of the traps in repair. The sudden application of 475 pounds upon a trap which is normally under only 125 pounds, causes some difficulty due to the packing becoming leaky.



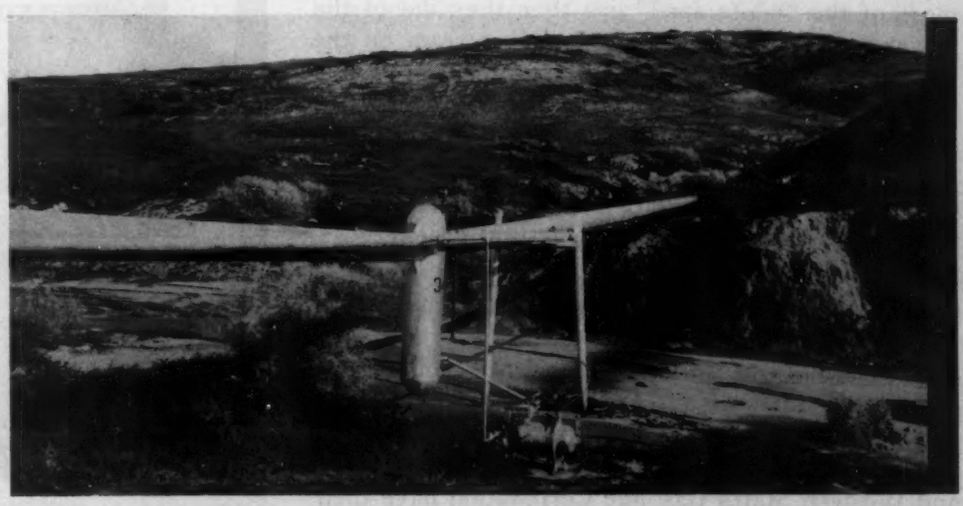
Pipe line drip in gas system, showing horizontal drip in use on intermediate pressure line and vertical drip on high pressure line.

In Kettleman Hills, it is not necessary to protect these drips and dump traps by frost boxes because the temperature seldom drops low enough to freeze the water condensed in the lines. In some cases, the drips are protected by high retaining boxes, but this is done to prevent sand and other rubbish from entering the excavations when rains occur. Often it is necessary to partly bury the lower ends of the vertical drips when the pipe lines are not supported the proper distance above the bottom of the draws and ravines. When this procedure is followed, the evacuating lines are led out of the excavations to the dump traps, which are placed on the ground level nearby.

The pipe line condensate gathered from all the drips in the field is transported through small lines, running from two to three inches in diameter, and terminating at a central collecting battery of tanks where it is stored and subsequently pumped to the several gasoline manufacturing companies for re-running through their plants. Kettleman North Dome Association does not operate a gasoline manufacturing plant, but distributes the wet gas and vapors, as well as the pipe line condensate to those who do.

Seven gasoline plants are being operated in Kettleman Hills, four of which are owned by Standard Gasoline Company. The three others are, Western States Gasoline Corporation, Los Nietos Producing & Refining Company and Superior Oil Company. These companies process all of the gas produced in the field by Kettleman North Dome Association, as well as that coming from all other wells on the structure. The amount of gas and condensate, in percentage, distributed to these companies is as follows:

Western States Gasoline Company	57.2899%
Standard Gasoline Company	24.4711%
Los Nietos Prod. & Ref. Company.....	17.8102%
Superior Oil Company	0.4288%
Total	100.0000%



Typical pipe line with drip which is evacuated by tilt-trap.

Design and Operation of

Kettleman Hills Gas Mixing Station

J. C. ALBRIGHT

BECAUSE of the varying amount of white sand gas produced in Kettleman Hills by Kettleman North Dome Association it was decided to construct a mixing header, through which all of the gas produced must pass before it finally is distributed to the companies taking the wet gas.

The installation is described in detail, showing the construction, metals used in fabricating the units and the manner in which it is assembled in the field. The metering and sampling devices are described, some of the equipment being new in design.

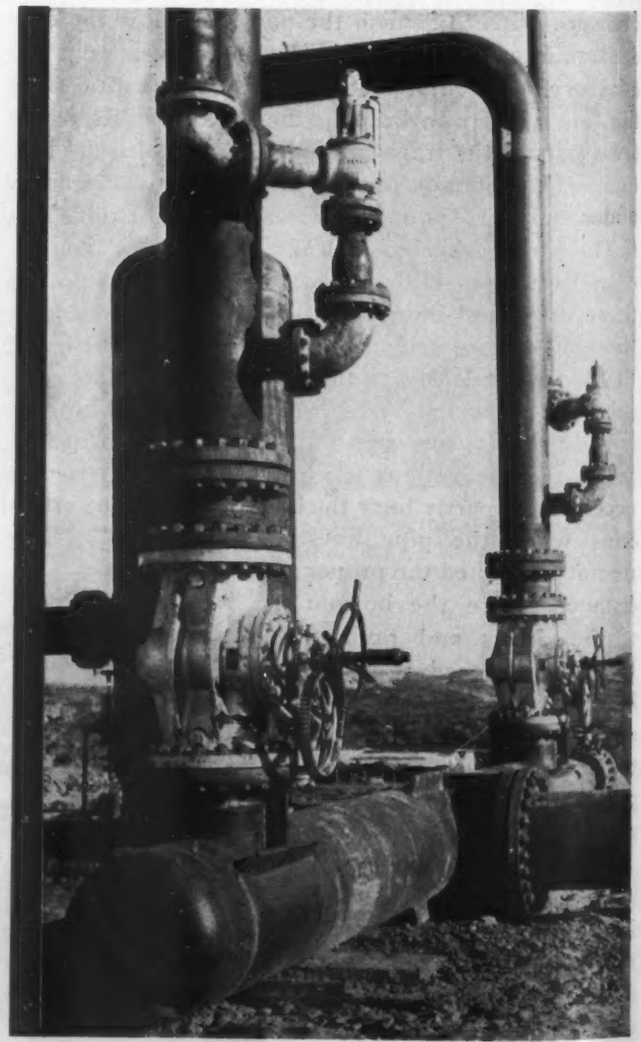
The gas must be delivered in the proper percentages of volume to three companies at all times, regardless of the amount of gas being produced, and the method of determining the amount and controlling it is described.

The mixing header has been successful in making a complete blend of the "white sand" gas from the crest of the structure and the "black sand" gas from the lower Temblor formation.

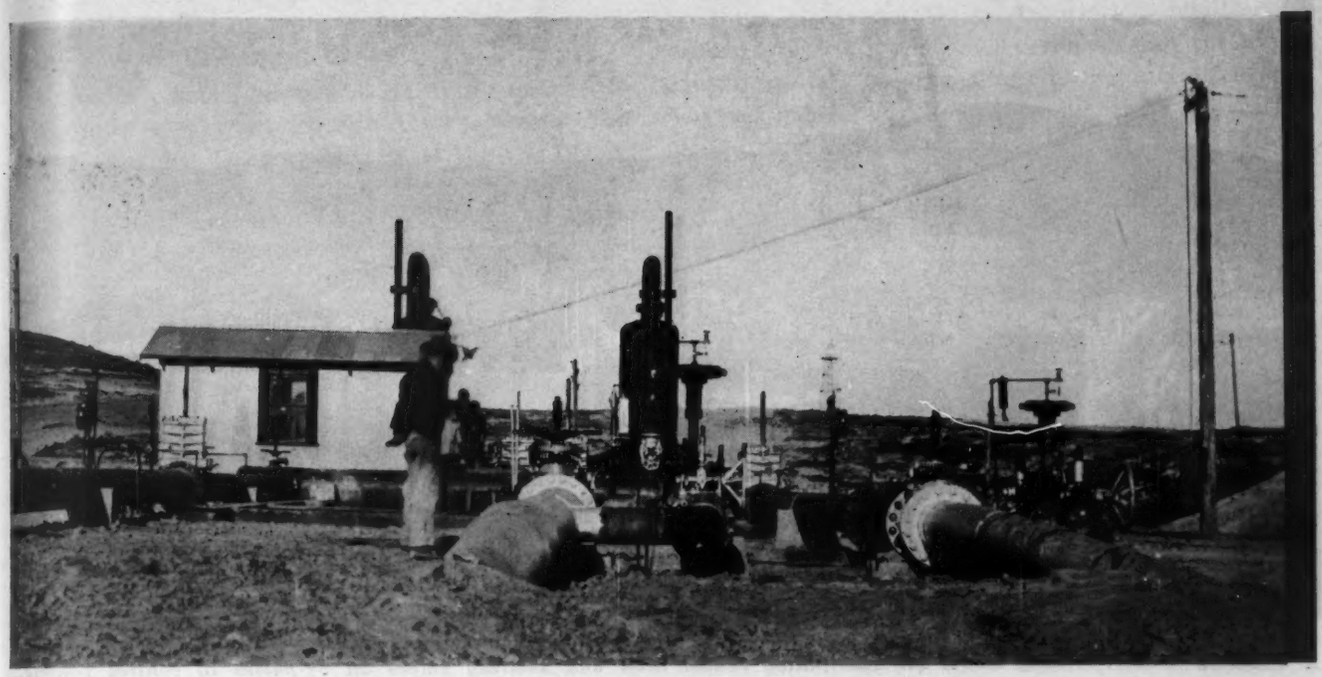
KETTLEMAN North Dome Association formerly distributed the wet gas gathered from wells to the gasoline plants in the field through individual lines tapped into the common main. During this period preceding, each gasoline plant received its percentage of the gas, but the percentage of the "white sand" gas and the "black sand" gas varied continually. When conditions were favorable for the maximum amount of fuel gas to be consumed in the more populous centers, a greater amount of "white sand" gas was produced. Gasoline plants that were taking gas from any point nearer the confluence of the two streams, naturally received more of the "white sand" gas than they did of the "black sand" gas. Others farther up stream on the "black sand" gas line received a minimum of the "white sand" gas. Because of this varying condition, and the accompanying varying composition of the wet gas treated, the plants were continually rearranging the operating procedure in order to produce the desired quantity and quality of natural gasoline.

To solve this problem and insure each plant its proper proportion of both types of gas, a central mixing header, through which all the wet gas is passed, was installed. This device is located at a point where the two qualities of gas are about equally divided, and where the three principal processors take their supply. Los Nietos Producing & Refining Company and Western States Gasoline Corporation have their plants in the same section with the header, and Standard Gasoline Company's pipe line passed near by. Superior Oil Company does not receive gas from the header, because of distance of its plant, and further it does not take a large amount from the association.

Extensive research was made by gas engineers of the participating companies to determine what re-



Gas mixing station showing how gas is brought from scrubbers to a 24-inch header through 20-inch risers.



View of Kettleman North Dome Association gas mixing station, Section 2-P, Kettleman Hills, where all gas is mixed prior to distribution to gasoline extraction plants.

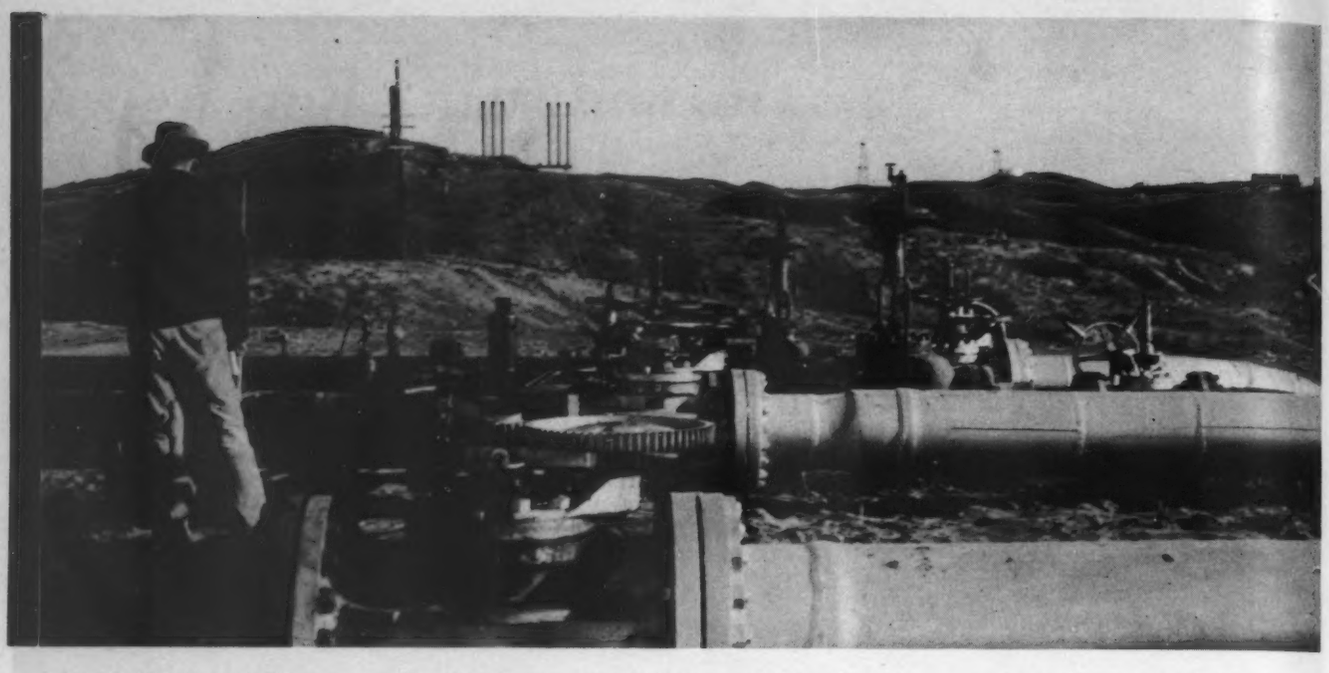
sults had been obtained by other companies when mixing gases having different composition. Perhaps no other field has been operated that produced such volumes of gases which required mixing before being processed. It was desired to completely blend the two gases produced without causing too great a pressure drop through the headers and mixing equipment, and to bring the blended gases back into a straight line flow so the whole could be measured by metering before and after distribution to the gasoline plants.

The white sand gas is brought into the location through a 14-inch transmission main from the crest of the structure and from wells not producing from the lower two zones in the Temblor. The black sand gas is moved from the northwest end of the field through a 20-inch main which serves all of the wells that are producing gas and oil from all of the five zones which do not contain the high gravity white oil. The black sand gas is produced with a more or less regular flow, depending upon the allowable amount of oil to be produced in the field, but the volume of white sand gas depends altogether upon the amount of stripped dry residue gas required by the utility companies taking fuel from the field.

From previous experience in delivering dry gas to the utility companies, it has been found that peak loads sometimes reach the total volume of 200,000,000 cubic feet daily. To handle this amount it was necessary to design the mixing header with units sufficiently large to carry the load without difficulty. The first problem was encountered in bringing in the white sand gas line in order that the first stage of mixing with the black sand gas could be easily accomplished, and that the condensate carried along with the gas after it had passed the last of the pipe line drips could be separated and disposed of.

The two lines are connected on opposite sides to a short stub header nine feet four inches in length. This header was fabricated especially for this installation, as was all other piping and vessels, and is made from fire box quality steel, one-inch thick, and is 24 inches inside diameter. A 16- by 23-inch flanged steel welding neck is attached to the side where the white gas enters, and an 18- by 28-inch similar fitting is welded to the side to attach the black sand line. The white sand line is swedged up from 14 inches to 16 inches, while the 20-inch black sand line is reduced in a similar manner to 18 inches. Adequate control fittings are placed in the lines where they are attached to the stub header by spur gear-operated plug cocks with heavy flanges.

This stub header in turn is connected to another header which is also 24 inches in diameter, inside measurement, by welding the open end to the second header at its longitudinal center. This welded joint is stiffened and made more secure by welding flat bars of steel to the fabricated pipe. One bar is welded to the stub header lengthwise so that one end of it appears at the seam on the upper side where the two headers are joined together. This bar is one inch thick, four inches wide and 26 inches in length. The other bar has the same thickness and width, but is 52 inches long and is welded to the second header in such a position that the end of the first bar touches its side, at which point the two are welded together. A like procedure was carried out on the opposite side



Mixing header, looking across the distribution header lines and showing valves on by-passes to control volume.

of the joint where the two headers were connected. This presents a connection both stiff and strong.

The second section of the header assembly is 24 feet long, having two connections attached to the side opposite to where the stub header is connected. Each of these is made by welding a flanged steel neck, 16 inches by 25½ inches, with walls ¾-inch thick, located with 10-foot centers, which place each connection two feet from its respective end, center of connection to end of pipe header. Each of these welded joints is stiffened with one-inch by four-inch steel bars in a manner similar to the first connection.

The next units in line consist of two vertical vessels which serve a dual purpose. One is in assisting in more thoroughly mixing the two gases, and the other to remove moisture and condensate from the gas as it passes through them. As each vessel is designed to handle an equal amount of gas, the construction is the same for both units. These vessels were designed and fabricated in accordance with the A.P.I.-A.S.M.E. Unfired Pressure Vessel Code. They are 60 inches in diameter by 12 feet in length. The walls of the vessels are firebox quality plate steel 1½ inches thick, which provide a corrosion allowance of 0.156 inches. Each end is made convex by using the same grade and thickness material. As they are designed to operate in a vertical position, the end designated as the lower is provided with a skirt welded to it and which is fitted with a flanged rim upon which the vessel rests.

Two flanged openings were made in the lower section, one of which is designed for the gas inlet, having a flanged steel welding neck, 15 inches by 25½ inches, attached and reinforced with a circular plate 30 inches in diameter by 1½ inches thick welded to the neck and sides of the vessel. Ninety degrees around from this connection, the other flanged opening was made to be used as the liquid level float manhole. It is attached in a similar manner and reinforced with a circular plate of steel. The outlet through which the condensate is removed, was made by welding a two-inch extra heavy connection 45 degrees from each flanged connection. The drain connection is made in a like manner, but the pipe extends through this fitting and reaches to the lowest point of the bottom head.

Gauge glass fittings are provided so the operators of the station can see the amount of liquid in the vessel while in operation. The upper end of each vessel is fitted with a flanged steel welding neck 18 inches by 28 inches in dimensions, reinforced with a circular plate of steel 30 inches in diameter by two inches thick, used as the gas outlet. The two vessels are erected on 20-foot centers, six feet eight inches from the first header assembly, upon five-foot concrete foundations. The first header assembly is attached to each vessel by two 90-degree extra heavy steel welding ells, fitted with a 16-inch lapped welding nipple, to which is welded a 16- by 25½-inch steel lapped flange on each end of the reverse bends. Spur geared lubricated plug cocks are fitted between the flanges of the header assembly and the connecting piping leading to each vessel, for control purposes.

To insure removal of all condensate entering the vessels with the mixed gases, each unit is equipped with mist extracters, made by using a bundle of one-inch pipe placed in a vertical position, running from the bottom of the vessel to a point near where the semi-elliptical heads are joined to the shell of the unit. A heavy oak baffle plate is between the pipe

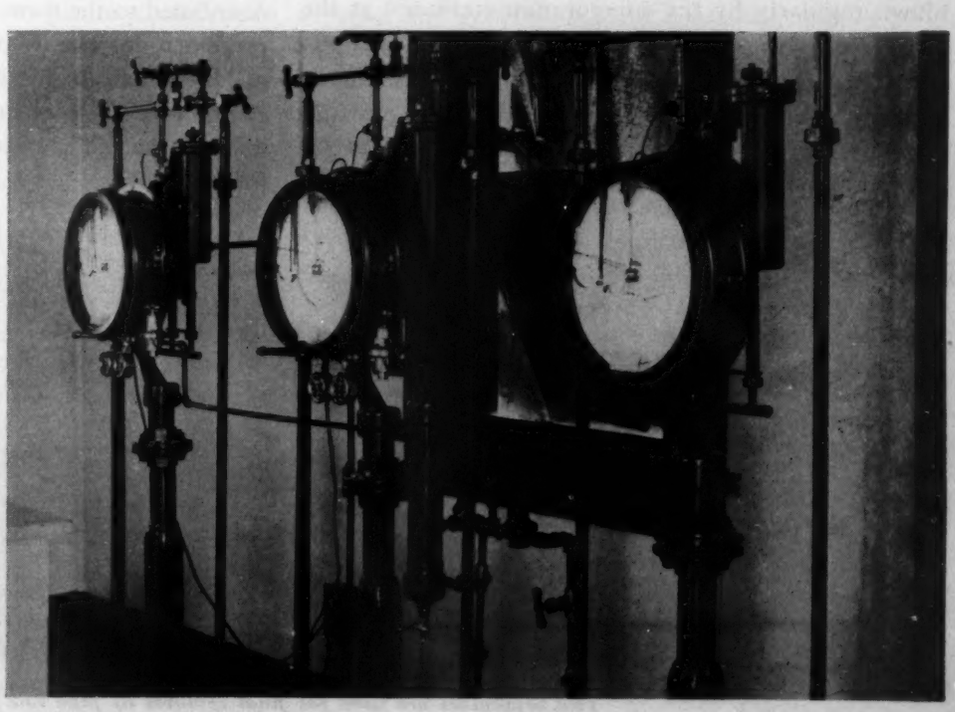
bundle and the opening through which the gas enters the vessel, two feet one inch in length, to deflect the liquids toward the base of the vessel.

The outlet connections are made by using two 90-degree extra heavy welding ells connected to a joint of 16-inch outside diameter pipe, four feet four inches long, running horizontal from the outlet connection, and dropping with a riser made from the same kind of steel pipe, 11 feet long, which is also flanged with a similar connection. Eighteen inches up from the last flange is welded a six- by 12½-inch flanged steel slip on nipple as a connection for safety valves.

An extra heavy plug valve is placed between the lower end of the riser and the next header. It rests upon connections made in a similar manner to those in the first header unit—to which the vessels were connected—which in turn are welded to the 24-inch inside diameter pipe and reinforced with bars of steel. This header is made from steel plates having a wall thickness of one inch, and an overall length of 31 feet 6 inches, but one end forming an extension five feet six inches long, swedged from 24 inches inside diameter, to 12 inches, which in turn is connected to a vent stack through which the gas may escape when it is found necessary to turn it to the air. A 22-inch flanged steel connection is placed in the longitudinal center of this header, ignoring the swedged extension, 90 degrees over from the vertical ones to which the risers from the vessels are bolted. This in turn is bolted to a meter run 22 inches inside diameter and 70 feet long.

The meter run is fitted with straightening vanes made by using seven annular rings of No. 16-gauge, 3½-inch outside diameter seamless steel tubes, held in place by the usual method in accordance with Southern California Meter Association details. An orifice fitting is in this meter run so that the entire amount of gas passing through the mixing header may be measured. To determine the temperature of the gas being metered, a half-inch by 12-inch extra heavy total emersion thermometer well, made from cold rolled corrosion-proof metal is installed down stream from the orifice fitting, but near enough that the temperature of the gas can not change appreciably. A recording instrument in this well records the temperature of the gas.

This meter run in turn connects to a distribution header made from one-inch steel plate 28 feet long, to which four flanged openings are connected. One is 16 inches, the next two are 14 inches, and the fourth, and the one on the opposite end, 12 inches. Meter runs of the same size pipe were laid from these connections, each being fitted with straightening vanes similar to the one used in the master meter run. At a point just before the master meter run is joined to the final distribution header, is a sampling connection to enable the gas testers to determine whether or not the gas has been thoroughly mixed before it is finally placed in the lines leading to the gasoline plants. Five sample cocks, with 1½-inch centers, extend downward into the pipe line 4¾ inches farther than the one above. The first takes gas one half-inch from the upper inside of the pipe line, and the fifth, or last one, takes gas one half-inch from the lower inside of the pipe. The gas enters each sampling connection squarely through the opening of the quarter-inch pipe, each having been bent 90 degrees, with successively



Recording and controlling instruments in the control room at the mixing station. Two on the right are equipped with telechron movements and regulate and control the amount of gas going to two of the three receiving companies.

longer ends so the gas may be removed from a common vertical line. Each opening looks directly up stream.

Three of the distribution pipe lines are in use, the larger (which is 16-inch) being used to transfer Western States Gasoline Corporation's quota to its plant. The one next to this, a 14-inch line, delivers gas to Standard Gasoline Company. The fourth is used to transfer gas to Los Nietos Producing & Refining Company. The Los Nietos and the Standard lines are each fitted with volume rate controllers, attached to the lines on a by-pass, which in turn are operated by instruments placed in a control room nearby. Western States Gasoline Corporation, by not being furnished with a volume rate controller, takes the remainder of the gas not delivered to the first two, but as the rate controllers are functioning at all times, the amount of gas handled is delivered in the proper percentage.

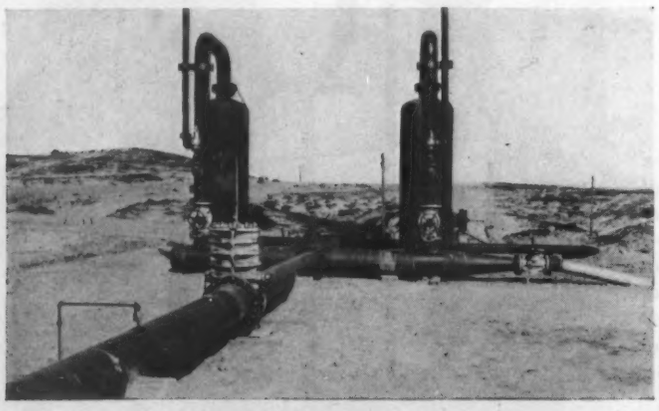
Separate meters are maintained on each distribution line, each company taking gas from the mixing header maintaining its individual measuring instrument, while Kettleman North Dome Association has attached a check instrument to the same orifice fitting, the lines of which lead to the control room. Static and differential piping leading from the orifice fittings to the instruments in the control room are all laid with a definite slope to prevent moisture and condensate from collecting in low places. The slope is gradual from the orifice fittings to a point approximately half way between the fittings and the control and recording instruments, where they terminate in drip pots, and take a definite slope from this point to the meters. Drip pots are large enough to contain any reasonable amount of fluid, but are blown regularly by the control man stationed at the mixing header.

As the gas metered to Los Nietos Producing & Refining Company and Standard Gasoline Company must be known at all times in order that the Western States Gasoline Corporation may receive its proper amount, the controlling instruments which operate the volume regulators on the by-passes are equipped with electrical clocks. Telephones are likewise placed in the control room so that the operator may be in touch with the dispatcher and gas engineers at all times, and if and when a "cut" comes through from the utility companies showing that less gas is required, the control operator may set the volume rate controllers to deliver the proper amount of gas to the companies.

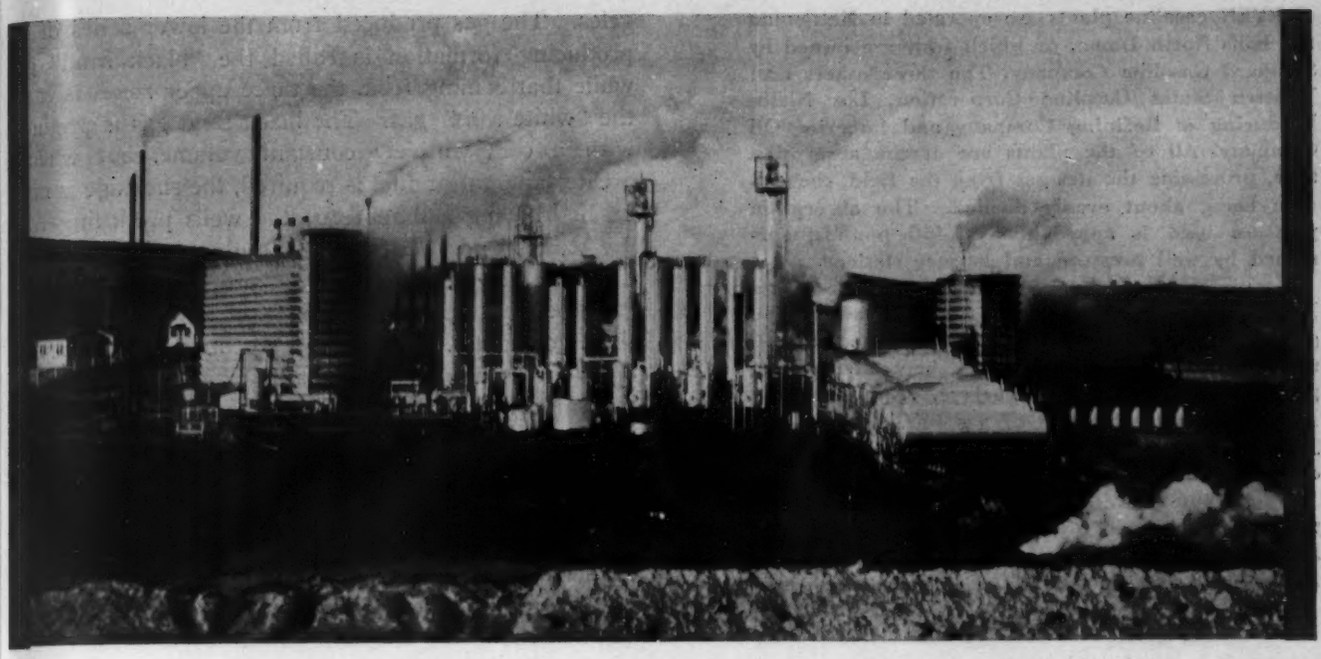
Condensate is removed from the mixing header at four points, one of which is located in the first header, the next in the vertical scrubbing vessels, another in the header immediately following the vessels, and the last in the header to which the distribution lines are connected. The liquid in the scrubbers, or vertical vessels, is removed through float controls which operate mechanically and maintain a predetermined level in the vessels. The other points are operated manually, so to drain these points, the operator must visit this header and open the drain valves. All of the condensate removed is blown through a three-inch line to the common condensate storage tanks from which it is measured and pumped to the respective gasoline plants in the same volume percentage as the wet gas.

When this data was secured in the field in February, 1935, the mixing header had not been in service a sufficient time to enable the interested companies to have an analytical test made of the wet gas after it had been passed through the mixing header, but according to field tests made in the routine manner, the gas was constant in its characteristics when a definite amount of white sand gas was blended with the black sand gas.

After the gas passes through the mixing header, it is distributed to the three gasoline companies, who in turn process it for the desired gasoline, and return the dry residue gas belonging to Kettleman North Dome Association to utility company meters that measure it into the lines of the utility companies taking fuel gas from the field.



Two separators are used for final removal of pipe line condensate from gas flowing to the mixing station.



Western States Gasoline Corporation natural gasoline plant at Kettleman Hills.

Kettleman Hills Natural Gasoline Plants

FOUR gasoline companies operate natural gasoline plants in Kettleman Hills. Standard Gasoline Company has four units, making seven plants manufacturing natural gasoline in that area. Western States Gasoline Corporation comes first in the allocation of wet gas from Kettleman North Dome Association's distribution header, receiving approximately 57½ percent. Standard Gasoline Company is second and receives approximately 24½ percent, while Los Nietos Producing & Refining Company processes approximately 18 percent. The remainder, or about ½ of 1 percent, goes to Superior Oil Corporation.

Thirteen producing companies are included in the Kettleman North Dome Association organization, and each is permitted to designate to which gasoline plant its portion of the wet gas may be delivered. General Petroleum Corporation has designated that its gas is to be delivered to the plants of Standard Gasoline Company. Western States Gasoline Corporation, which receives the major portion of the wet gas, processes that part representing the gas from the following companies' percentage: Milham Exploration Company, Continental Oil Company, Pacific Western Oil Company, Standard Oil Company and Amerada Petroleum Corporation. Los Nietos Producing & Refining Company which is third in the list, processes gas allocated by Shell Oil Company, Union Oil Company of California, Associated Oil Company, Pioneer-Kettleman Company, Belmont Investment Company and Petroleum Securities Company. Superior Oil Corporation only processes the amount of gas produced from Helm & Gilman's properties. Companies which have producing properties in Kettleman Hills not included in the association, deliver the wet gas from their wells through separate pipe lines and have different working agreements. Standard Oil Company, owning approximately half of Kettleman Hills in fee, processes the gas from its wells through its own gasoline plants, which are operated as Standard Gasoline Company, and maintains gathering, transmission and distribution systems entirely separate from those of the association.

The three plants operating independently in Kettleman Hills are similar to other gasoline plants situated in California and elsewhere. Superior Oil Company and Western States Gasoline Corporation have like equipment (Braun) while Los Nietos Producing & Refining Company is operating the Foster Wheeler system. All the plants are processing the wet gas at a pressure of about 450 pounds gauge. The association maintains that pressure at the gates of each individual

SEVEN gasoline plants are operated in Kettleman Hills North Dome, of which four are owned by Standard Gasoline Company. The three others are: Western States Gasoline Corporation, Los Nietos Producing & Refining Company and Superior Oil Company. All of the plants are of the absorption type, processing the wet gas from the field, the volume being about evenly divided. The absorption pressure used is approximately 450 pounds, furnished by well pressure and booster stations.

Temperature of the gas produced averages from 135°F. to 165°F., which makes it necessary to use gas coolers. One concern uses an intermediate system of cooling the absorption oil between the high pressure pumps and the absorbers. Approximately 12,675,000,000 cubic feet of gas were processed in January, 1935, which has an average extraction value of about 1.2 gallons per thousand cubic feet.

All gasoline manufactured in the field is stabilized to either 22-, 24- or 26-pound, natural, with the overhead cut from the stabilizer being used, in some instances, to manufacture liquefied petroleum gases.

Steam from the preheaters, after heaters and exhaust of the pumps is used to make boiler feed water. It is condensed in two ways. One method contacts it in a heat exchanger through the use of expanded propane, and the other makes use of atmospheric coolers, depending upon the heat being extracted by contact with the blowing wind.

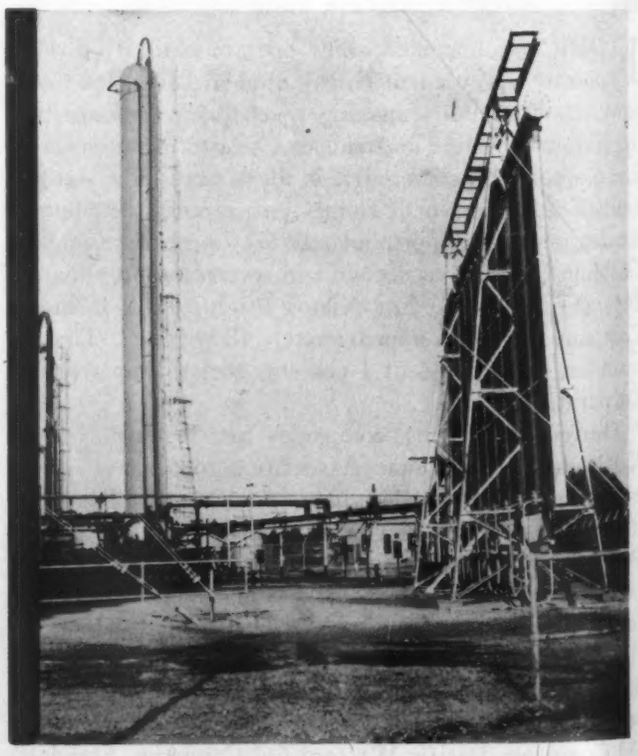
plant, not so much from an extraction standpoint, but in order that the dry residue gas may be received back by the organization at a pressure sufficiently high that it can be placed in the pipe lines of the gas transportation companies shipping fuel from Kettleman Hills.

The gasoline companies receiving the bulk of the wet gas take their percentage of the total mixed gases from the mixing header installed by the association in Section 2-P near the plants of Western States Gasoline Corporation and Los Nietos Producing & Refining Company. As two different types of wet gas are produced in the field, it was found expedient to blend them before distribution. Standard Gasoline Company, Western States Gasoline Corporation and Los Nietos Producing & Refining Company each have a line leading from this header, but Standard Gasoline Company placed its portion in its own gathering system to be processed along with the gas coming from its individual wells. The association maintains rate of flow controllers in the distribution lines which allows them to deliver the mixed wet gases to the different companies in the proper proportion, excepting Superior Oil Company. This company has a plant that is so far removed from the mixing header, and also receives such a small percentage of the total, that it was found impractical to lay a line to carry its gas, so the volume allocated to it is made up of the "black sand" gas produced near the plant.

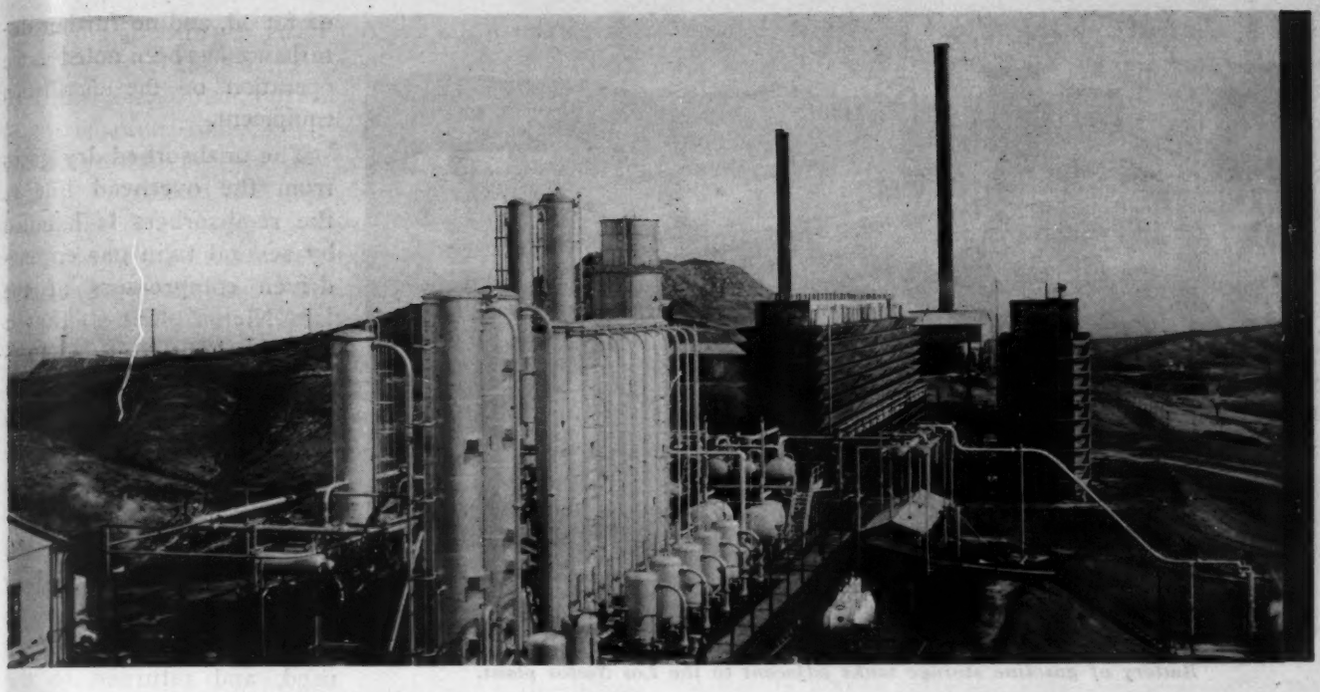
The amount of gas processed by the plants in Kettleman Hills varies from day to day, because of the restrictions placed upon the field that do not permit the production of a total volume greater than can be used in the field as fuel, and that moved through the transportation lines leading to San Francisco and Los Angeles. The gas produced from the lower zones of the producing formation is called the "black sand" gas, while that coming from the three upper zones is called the "white sand" gas. The black sand gas is produced with a comparatively constant volume, but when a greater amount of fuel is required, the shortage is made up by flowing a number of the wells producing from the white sand. Rearranging the amount of gas produced varies from day to day, and because of this, the gasoline plants check the content of the gas delivered to them constantly. Knowing the content of the gas, the operation of the plants is made easier, so each plant is informed in advance when a change is to be made, which is usually predicated upon the following 24 hours requirements.

Los Nietos Producing & Refining Company, as well as other plants in the field, take gas from outside producers who have wells located in a small portion of the field, as well as the ratable production received from the association. The gas is ordinarily much too warm to process through the high pressure absorbers without cooling. Los Nietos Producing & Refining Company uses shell and tube exchangers through which the gas passes before admitting it to the absorbers. This gas varies in temperature, running as high as 160°F. in some instances, especially if it is being produced from wells with a low tubing pressure. Higher producing pressures permit expanding through the flow beans at the Christmas trees which reduces the temperature of some of the gas, but it again is necessary to reduce the temperature at the plant.

After the gas has been cooled in the shell and tube



Fractionator and steam condensing equipment at Superior Oil Company's Kettleman Hills natural gasoline plant.



Los Nietos Producing and Refining Company, natural gasoline plant at Kettleman Hills.

exchangers, it is admitted to a battery of nine high pressure absorbers, where it is contacted with the usual grade of mineral seal oil to remove the desirable natural gasoline fractions. Upon being stripped and after it leaves the column, the gas passes through the after scrubbers into the meter run of Kettleman North Dome Association to be measured into the lines of the utility companies.

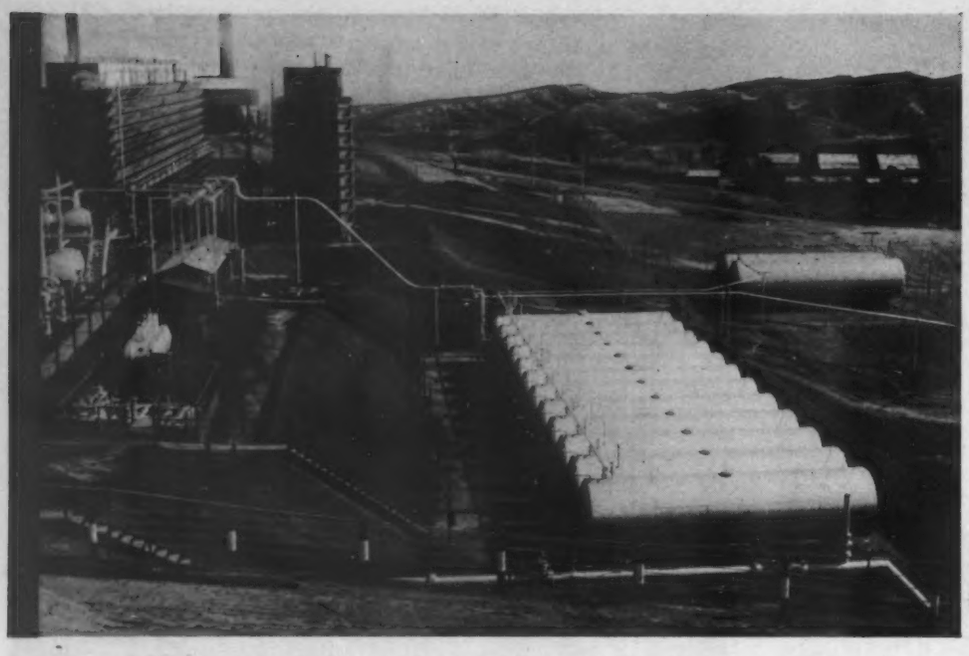
The absorption oil is handled in Los Nietos Producing & Refining Company plant by multistage, centrifugal pumps driven by steam turbines. A similar drive is used by Superior Oil Corporation. In the Los Nietos plant, before the oil is introduced into the high pressure absorbers and after it has passed through the multi-stage centrifugal pumps, it is intercooled in shell and tube exchangers, because it was found that upon placing a pressure of 475 pounds upon it the temperature rose appreciably; enough, in fact, that this company deemed it worth while to install the battery of intercoolers.

After the oil in the Los Nietos plant has removed the essential fractions from the wet gas, it is removed from the base of the absorbers through liquid level controllers in the usual manner. Two distillation units have been set up in both the Los Nietos and the Superior Oil Company plants which may be operated in parallel, or each separately. When running at approximately full load, each distillation unit takes its share of the fat oil, which is handled by rate of flow controllers. If the rate of gas moved from the field does not justify both units, one only is operated, but in January, approximately 12,675,000,000 cubic feet of both "white sand" gas and "black sand" gas was produced in Kettleman Hills, and processed through the seven gasoline plants. This was approximately 408,000,000 cubic feet per day, and of this amount, association wells produced 43 percent. If equally divided between the seven plants, each would have processed approximately 60,000,000 cubic feet per day.

FAT OIL RECTIFIERS

Some of the plants that operate in this area use fat oil rectifiers that stabilize the oil and gas in solution before distillation, which is claimed by some to improve the operating conditions and to relieve the load upon the stills. This system only recently has been placed in operation, and not enough information has been released on the subject that the system can be described in detail. Generally, however, three vent tanks are used in series with a column similar to a fractionator or bubble column equipped with plates over which the fat oil travels in the same manner as it would if it were passed through a still. Only enough temperature is placed upon the saturated oil to remove the undesirable fractions. These are removed from an overhead line which is kept at a sufficiently low temperature to prevent escape of fractions that it is desired to retain.

Los Nietos Producing & Refining Company and Superior Oil Corporation, however, follow the well established routine of passing the fat oil into a vent tank before it enters the exchangers, where the lighter fractions are allowed to escape to the condensers through a by-pass around the still. After being treated in the exchangers, the oil is again passed through a vent tank, and the vapors removed are also by-passed to the condensers, while the oil processed through the preheaters enters the stills. Both the Los Nietos and Superior plants use liquid reflux pumped from an accumulator tank to control the still overhead outlet temperature, but Western States Gasoline Corporation uses overhead reflux condensers and maintains an overhead temperature by controlling the amount of water pumped



Battery of gasoline storage tanks adjacent to the Los Nietos plant.

through the tube and shell units on top of the columns.

The Los Nietos plant vents the oil from the exchangers after it has been stripped in the stills to an atmospheric pressure tank from which it is picked up and passed through the atmospheric sections in the louvre tower. It is again picked up by high pressure pumps and delivered back to the absorbers. A part of this oil is used in the low pressure absorbers which are operated at about the condensing pressure of the gasoline. Vapors from the accumulator tanks are directed to two columns which are operated as tail, or re-absorbers, and the fat oil from them is processed with the fat oil from the high pressure absorbing column.

The oil coming from the low pressure absorbers usually has a higher saturation than the fat oil from the high pressure columns, and when the plant was first placed in operation, some difficulty was noticed which was attributed to slugs of the higher saturated oil entering the stills from time to time. Attempts were made to control the flow of oil from both units of absorbers so the amount would be equally blended, but the operators were unsuccessful until a change was made in the fat oil common line leading to the heat exchangers.

After several experiments in attempting to control the situation, the common fat oil line leading from both batteries of absorbers was excavated and another laid in its place. This new line was of the same size as the older one, being eight inches in diameter, but had an additional piece of equipment placed inside. This was in the shape of an ordinary screw conveyor, but placed in the line stationary so that both types of fat oil were forced to travel in a more turbulent manner than if they were flowing through an ordinary pipe line. Subsequent operation of the plant has proven that a complete mixture has been obtained between the two classes of fat oil, and no further disturbance has been noted in the operation of the distillation equipment.

The unabsorbed dry gases from the overhead line at the re-absorbers is handled by several twin gas engine-driven compressors at the Los Nietos plant so that it may be boosted to a sufficient pressure to permit addition to the dry residue from the high pressure absorbers. All gas is metered into the plant, and the residue metered out. Gas used for fuel also is metered so that an account may be made of all gas processed, used, and returned to the association.

Pipe line condensate received in the proportionate amount, as determined by the rate at which the Los Nietos plant is to receive wet gas, is processed in the plant to improve the end point and color. Ordinarily no crude oil is gathered from the traps and high pressure separators, but the color is sometimes not sufficiently high to warrant the drips being placed in the receiving tanks along with the regular make. Other condensate is received by the Los Nietos plant through lines coming into the plant from another direction, the line carrying the gas from which the condensate is received travels from the north side of the structure up a ravine to the plant. Because of the steepness of the incline, it was necessary to place large tanks at some distance from the plant to receive the drips so that the gas line could be kept free from liquids.

Fractionation of the natural gasoline manufactured in Kettleman Hills is performed in about the same manner as in other fields. The majority of the plants make only a standard specification natural gasoline with a vapor pressure of from 22 to 24 pounds, Reid. Los Nietos Producing & Refining Company has installed a constant vapor pressure recorder in its plant to enable the operators to determine from inspection of a standard chart the condition of the finished gasoline from the fractionator kettle. If conditions within the plant should change, either gradually or abruptly, the operator can make the necessary corrections.

Other products are manufactured in Kettleman Hills besides the regular standard grades of natural, but to a limited extent. Other products could easily be made from either the overhead vapors, or split up into the various components, if the distance from markets was not prohibitive. Superior Oil Corporation has installed a supplementary column to fractionate out of the overhead vapors coming from the stabilizer a

grade of liquefied petroleum products used in increasing volumes on the Pacific Coast. This product varies as to the composition, but contains butane and propane in combination, sometimes running 60 percent butane and 40 percent propane, while at other seasons of the year, it is changed to contain about 70 percent butane and 30 percent propane. This product is transported from the field by truck and trailer to the point of use, principally to the Los Angeles Basin, but increasing amounts are being used in agriculture for tractor fuel.

Steam is used almost exclusively for power in the gasoline plants in driving pumps and other circulating apparatus because of the large amount of fuel gas available. In some instances the boiler plants are located at a distance from the other equipment so the fire hazard will be minimized. Several methods of treating water for boiler use are installed, but the principal method is a form of zeolite softening. Some experiments have been carried out with an electrical process, but only one plant has installed a system of that character. Sufficient data is not available to make a comparison between that system and the more often used methods.

Because of the hardness of the water, the plants generally recover all the condensate possible from preheaters and exhaust steam to be returned to the boiler feed water make up tanks. In some of the plants as much as 80 percent of the steam is recovered as condensate to be used again. The Los Nietos plant is using excess overhead vapors from the regular fractionator as boiler fuel, but to obtain the best results, it was thought necessary to warm the gases to a higher temperature than usual. To accomplish this, a surplus exchanger is used through which exhaust steam is passed on one side of the tubes, while the liquid and vapors from the reflux accumulator at the stabilizer are fed to the other side of the tubes. This method not only furnishes a sufficient amount of cooling necessary to condense the steam coming from the various units, but warms the propane and other fuel fractions sufficiently that they can be used under the boilers. The production of exhaust steam and overhead vapors is practically constant, and after the needle valve on the outlet from the accumulator has been set to provide the proper escape of the material, cooling becomes more or less automatic.

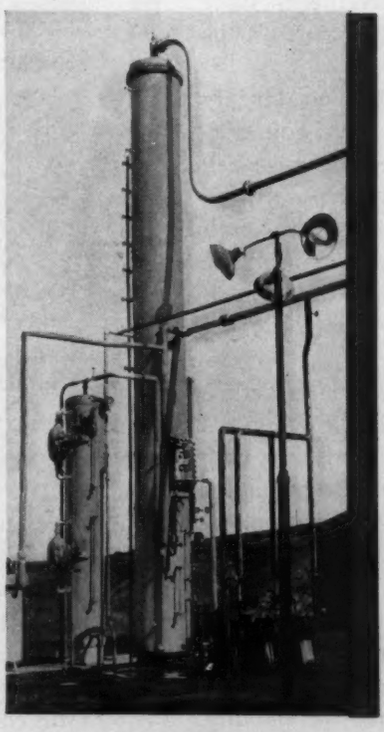
Superior Oil Corporation uses an especially built atmospheric condenser through which the steam from pumps is passed in order to recover the water. Ten sections of atmospheric coolers are used in this installation, set in a vertical position in a steel frame for rigidity, with the exhaust steam line running along the top of the assembly. The top header of each section is connected at both ends to the steam line, which permits it to enter at two points.

A common header to which a series of goose-necks are flanged lays near the lower end of these sections and the opposite end secured to the outlet of the coolers. The condensate is received in a drum at atmospheric pressure, where it may flow by gravity to the boiler room on the opposite side of a ravine from the plant. This unit depends altogether upon atmospheric cooling to condense the water from the exhaust steam, and the efficiency depends upon wind velocity to a great extent. However, a large amount of water is recovered from the exhaust steam that would otherwise be lost if no other method of condensing was used.

Most of the plants in Kettleman Hills, as in other localities, are not equipped with an oversupply of cooling towers, and securing the proper temperature on gas and oil, as well as the condensing coils, becomes a serious problem, especially in summer. Winds are light and variable as a rule, but at times they assume gale-like proportions which aggravates the cooling proposition, because of the high rate of wind loss which occurs at such times. At other times when the winds are not stiff, the atmospheric temperature is high, which results in unbalanced plant operation.

Water is not produced in Kettleman Hills proper, but must be pumped a distance of several miles from wells in the Tulare Basin, which borders the hills on the northeast. Most of the water has a peculiar habit of forming "barnacles" inside the main water lines. This deposit does not seem to be an iron compound caused from pitting of the steel pipe, but apparently comes from some substance within the water itself. These "barnacles" hang on the inside of the pipe lines in long, finger-like shreds which can only be removed by running a go-devil through the lines at regular intervals.

Practically all of the gasoline produced in Kettleman Hills is moved through pipe lines. Some of it is transported to deep sea loading bases, while a portion goes to refineries at Los Angeles and San Francisco. Very little of the product, other than the propane-butane fuel for trucks and tractors, is moved out by truck and trailer tanks because of the great distances.



Los Nietos Producing and Refining Company uses the absorption oil reconditioning system as shown.

Solvent Refining Lubricating Oils

At Associated Oil Company's Avon Refinery

ASSOCIATED Oil Company, pioneer of many advances in petroleum technology, introduced the first solvent refining process for petroleum products into the United States in 1925, by constructing the first Edeleanu SO_2 plant in America at its Avon, California, refinery.

This process was originally applied to the manufacture of kerosene and due to its immediate and phenomenal success in this field experiments were undertaken looking towards its application to heavier stocks, including transformer, spray, and motor oils and industrial lubricants.

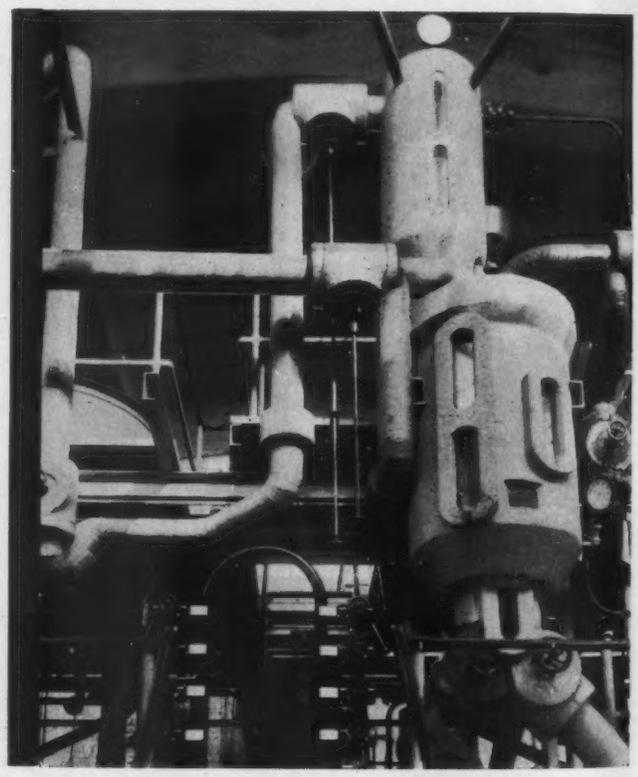
Experiments by the research and development division in 1927, and processing improvements since that time have led to the manufacture of a new type of products.

This progress was facilitated and even largely made possible through operation of a semi-commercial solvent refining plant erected in the research and development laboratories for this purpose.

Numerous charging stocks were processed through this plant, including wax-free heavy crudes, paraffine long residuums and variously produced lube distillates from many sources, including practically all major oil fields of California.

Coalinga crude was selected for the manufacture of New Cycol because it possessed the following advantages over other stocks processed: 1. Being wax free it permitted the manufacture of exceptionally low cold test oils without a dewaxing operation. 2. It contains a relatively high percentage of hydrocarbons suitable as lubricating oil. 3. The lubricants produced from it by the company's advanced methods show remarkable stability under any type of use as well as the excellent properties as lubricants (see Navy bearing work factor and lube oil stability tests).

Starting with the finest raw materials available, every step of handling and processing in the manufacture of New Cycols, from the production of crude at the well to the distribution of finished products, is under continuous examination. Proper segregation, storage and transfer of selected crudes; improved methods of vacuum distillation for the separation of undamaged lubricant stocks; various methods of applying solvents to lube stock and various ratios of solvent to oil; the newest methods of separating solvent refined stocks into the respective S. A. E. grades; and of packaging and shipping the finished oils, all come in for their proper share of attention. Not only are these processing studies



Associated Oil Company's pilot Edeleanu solvent plant in which all experiments are carried out.

carried on, but sufficient finished oil is produced by the more suitable methods for the most critical consumer examination.

A consumer's laboratory is maintained in which the various products are given the most severe service possible in motors, bearings, car journals, gear boxes, and extreme pressure machines as occasion requires and the results rigidly compared with those obtained when using the best of competitor's products and those of the company's own previous manufacture. All automotive products are also put into actual road service in both specially equipped and standard cars of various makes. This is the final test and performance must be thoroughly satisfactory before the new developments are placed in production.

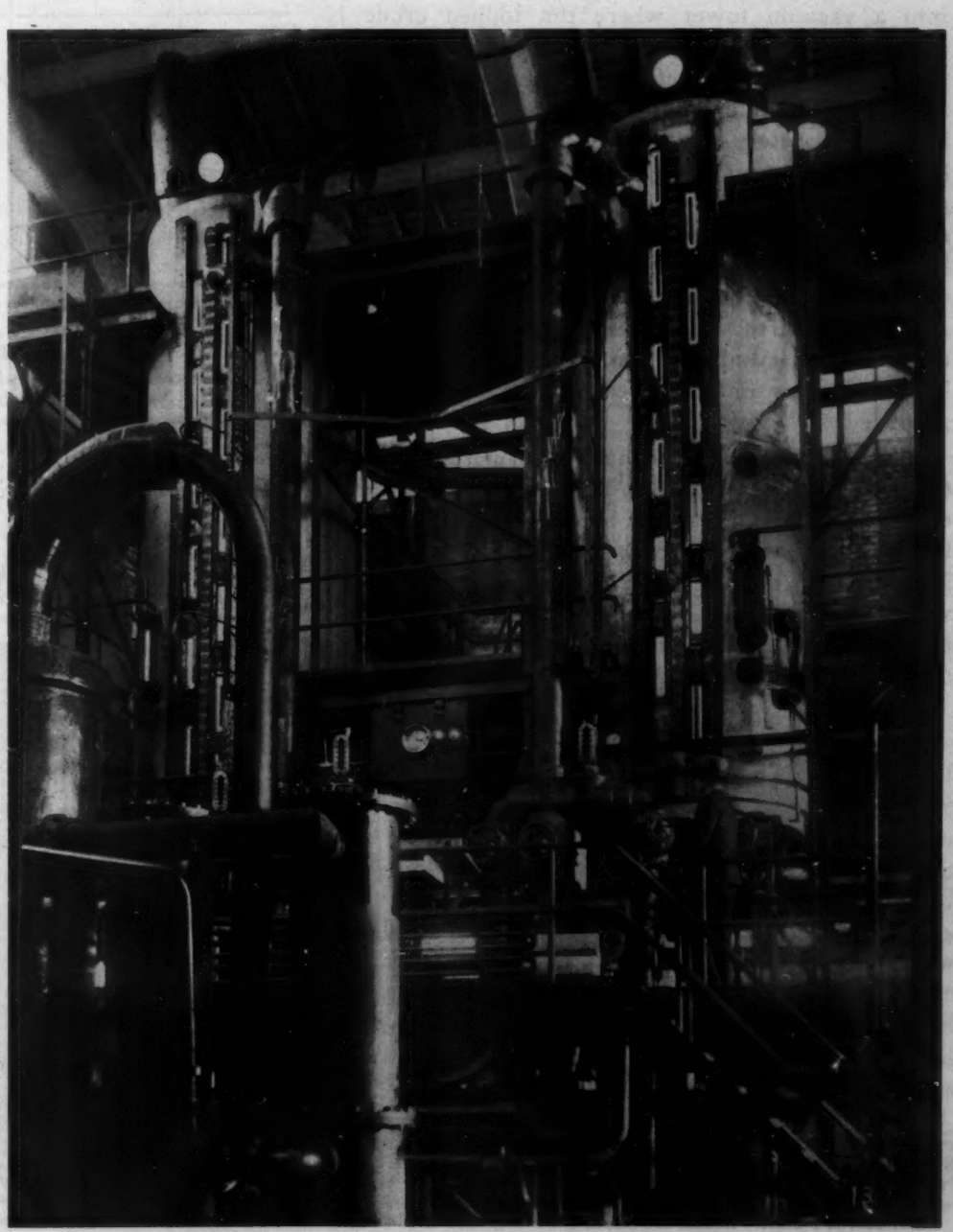
New laboratory tests have also been worked out and correlated with performance, so that advance information on the products may be more quickly obtained. Of these the motor oil stability test is an excellent example.

TABLE 1
Coalinga Crude Properties

		Approx. Breakup of Coalinga Crude	
Gravity	16	Tops	15.0 Percent
Cold Test	0° F.	Diesel	10.0
Sulfur	0.7	Lt. Lub & Transf	15.0
S. F. Viscosity @ 122	67	Medium Lub	20.0
Percent 20 Pennsylvania Asphalt	25	Heavy Lub	10.0
		Asphalt Btms	30.0
		Total	100.0 Percent

The general process by which these oils are produced in the refinery is as follows:

Coalinga crude having the properties shown in Table 1, is charged to a distillation unit including an atmospheric topping tower, a tube furnace and a Badger vacuum distillation unit. About 20 to 25 percent of tops and Diesel oil are removed at a tem-



Interior of Edeleanu solvent plant at Avon, California.

TABLE 2
Primary Raw Lub Distillates
Raw Lub Distillates from Primary Distillation

	Grav.	Flash	C.T.	VISCOSITY 100	130	210	Slope	GVC	C. Res.	Color	S.
COH..	22.5	280	0	57	44	....	295	0.896	None	2	0.75
USD..	18.4	350	0	217	98	43	287	0.906	Tr.	4½	0.77
MSD.	15.3	430	0–10	2,499	666	84	300	0.910	0.33	6–7	0.80
LSD..	14.6	475	10–20	12,000	2,471	179	288	0.904	0.53	.....	0.80
Btms..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....

perature of about 480°F. in the preliminary topping tower. The topped crude is pumped, without cooling, through the convection and radiant sections of a pipe still at relatively high velocity and arrives at the outlet or transfer line with a temperature in excess of 700°F. A flue gas temperature for this unit of around 400°F. indicates efficient absorption of heat by the furnace tubes and convection section.

The transfer line from this furnace discharges into a vacuum tower where the topped crude is carefully distilled at an absolute pressure of less than 50 mm. into fractions of various viscosities, and asphaltic bottoms. The streams may either be treated separately for various products or blended back for treatment as a long cut distillate. The asphaltic bottoms as well as the side streams are removed from the tower and pumped through coolers by a battery of vertical centrifugal pumps. The lube stocks are delivered to the solvent refining plant. About 5000 barrels of raw crude per day is charged to this primary distillation unit and about 1700 barrels per day or 34 percent of raw lube distillate produced.

The raw lube distillate having properties similar to those shown in Table 2, is charged to the Edeleanu solvent refining plant for the removal of non-lubricating material by SO_2. The dry raw lube stock is charged through a series of heat exchangers, by which it is cooled and the emerging raffinates and extracts warmed, into the mixers where it is thoroughly mixed with liquid SO_2 (about 300 percent by volume) at a somewhat reduced temperature. This solvent refining unit can be operated either batch or continuously, the latter method being usually employed.

The SO_2 soluble portion of the oil or extract is drawn off from the mixers or settling tanks through one line, while the SO_2 insoluble portion or raffinate is drawn off through another line to form semi-finished lubricating stock.

The solvent, liquid SO_2, is recovered from both extract and raffinate. They are therefore run through two separate series of steam distillation units in which the SO_2 is evaporated, the vapors taken to recompressors and coolers and finally, after condensation to liquid form, returned to solvent storage.

Table 3
Characteristics Solvent Refining Action.
Vacuum Distillate Charged

	Grav.	Flash	C.T.	VISCOSITY 100	120	210	Slope Value	GVC	C. Res.	S.
Charge....	16.1	.....	.....	1,952	533	75	302	0.905	0.09	0.69
Raff.....	21.5	.....	0	750	275	64	270	0.865	0.01	0.45
		Sp. Gr.								
Extract....	.....	1.055	.....	.....	2,245	115	350	1.023	0.86	1.2+

Raffinate 65 Percent. Extract 35 Percent. ±

Cycol S.A.E. 30 Stock

	Grav.	Flash	C.T.	VISCOSITY 100	130	210	Slope Value	GVC	C. Res.	S.
Charge....	15.6	405	0	1,397	438	65	298	0.913	0.54	0.75
Raff.....	22.4	405	0	694	261	61	274	0.859	0.03	0.42
Extract....	10.0	405	0	.....	.....	94	.....	0.960	1.54	1.30

Raffinate 65 Percent. Extract 35 Percent. ±

TABLE 4
1934 Cycols*

	10	20L	20	30	40	50
Grav.....	23.5	23.1	22.8	21.9	21.0	20.6
Flash.....	400	395	395	410	425	475
Fire.....	435	445	450	460	470	545
Pour ° F.....			0—All pour tests 0° F. ±			
Viscosity 100.	247	318	435	640	1,086	2,044
Viscosity 130.	114	137	179	243	369	648
Viscosity 210.	46	48	52	59	68	90
Slope.....	275	280	280	280	280	276
G.V.C.....	0.864	0.864	0.862	0.864	0.866	0.864
			Tr.			
Carb. Res.....	0.02	0.02	0.03	0.05	0.06	0.12
Navy Bear. Work Factor	0.95	0.95	0.95	0.95	0.95	0.95
Emul. 130....	OK	OK	OK	OK	OK	OK
Color.....	3.5–4.5	3.5–4.5	.....	3.5–4.5	.....	3.4–4.5
S.....	0.42	0.44	0.42	0.43	0.45	0.45

All colors are brought within the limits 3.4–4.5.
*Dr. Lazar's Test Data.

TABLE 5
Work Factors—The following work factors obtained on Navy Test Bearing, Avon Refinery.

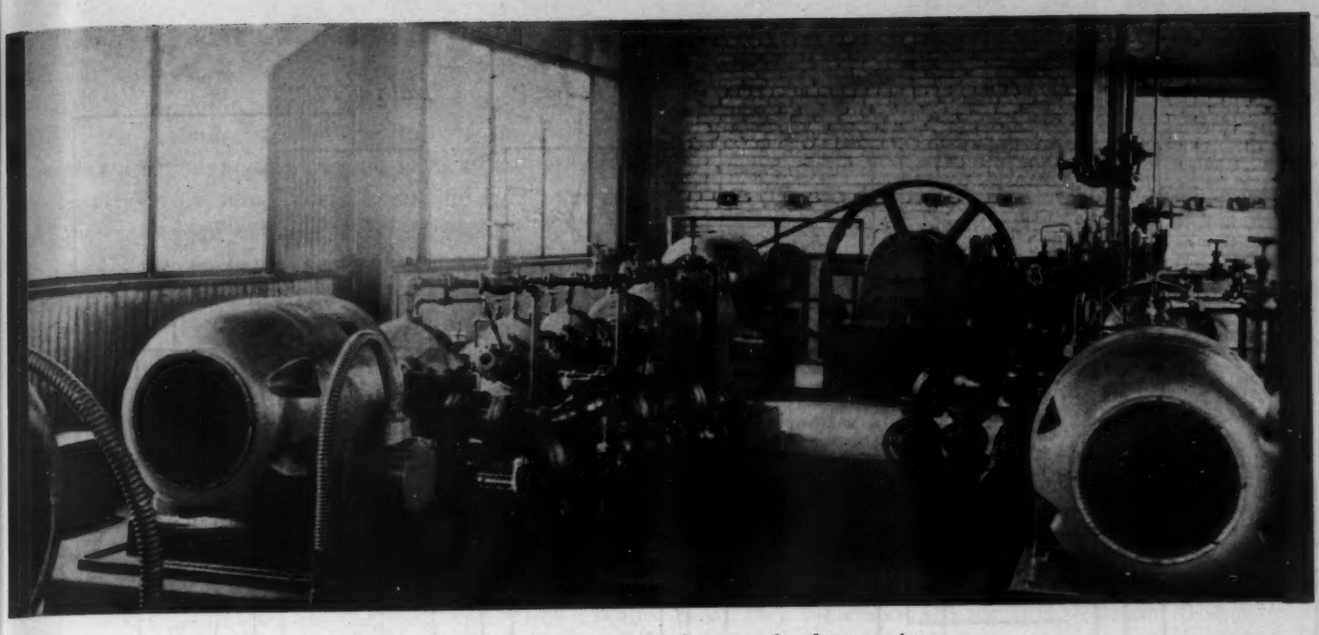
New Cycol.....	S. A. E. 30	.95
100 Percent Pennsylvania.....	S. A. E. 30	.95
Western Oil No. 1.....	S. A. E. 30	.85
Western Oil No. 2.....	S. A. E. 30	.70
Western Oil No. 3.....	S. A. E. 30	.64

TABLE 6
Engine Tests—25-Hour Dynamometer Tests

Oil Designation	VISCOSITY INCREASE Saybolt Secs. 100°F.	130°F.	210°F.	Motor Sediment Percent by Vol.	CARBON RESIDUE Orig. Oil	Used Oil	Carbon —Gms. Piston and Comb. Chamber
New Cycol.....	23	8	0	.1	.02	.18	1.5
100 Percent Pennsylvania...	30	10	0	.2	.72	1.03	3.8
Western Oil No. 1.	107	47	4	.6	.32	.79	2.1
Western Oil No. 2.	209	80	9	.4	.44	.72	2.7
Western Oil No. 3.	274	82	9	.8	.17	.73	2.3

TABLE 7
Stability Test—S.A.E. 30 Motor Oils

Motor Oil	Method of Processing	Sludge by A. O. Co. Stability Test Gms./Gal.
New Cycol.....	Solvent refined and double vacuum fractionated.....	1
100Percent Pennsylvania.	.....	1
Western Oil No. 1.....	Distilled and solvent refined.....	15
Western Oil No. 2.....	Distilled and acid treated.....	130
Western Oil No. 3.....	Distilled and acid treated.....	140
Western Oil No. 4.....	Blend of California distilled and acid treated oil with Midcontinent stock.	10
Western Oil No. 5.....	Distilled and acid treated.....	32
Western Oil No. 6.....	Distilled and acid treated.....	107
Raw Stock.....	.....	154



Pump room in Associated Oil Company's plant at Avon.

The extracts become fuel oil or raw material for various by-products.

The raffinates are sent back to the secondary distillation unit for rerunning and if necessary for segregation into various S. A. E. grades. Characteristic tests on a charging stock and the resultant raffinates and extracts are given in Table 3. Yields of raffinate from Coalinga stocks vary from 60 to 70 percent according to solvent ratio, treating temperature, manner of solvent application, and charging stock.

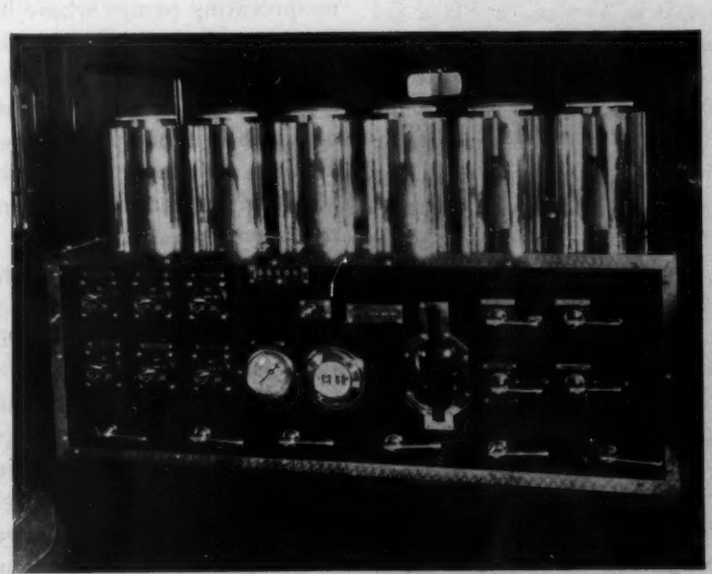
Raffinates are rerun through a second Foster Wheeler tube furnace and fractionated in a twelve-plate vacuum tower, from which a number of side streams are taken off for the segregation into various S. A. E. grades. These grades can be cut direct or obtained by blending the different side streams in suitable proportions. The furnace outlet temperature for this operation is about 675°F. The redistillation takes place under an absolute pressure of less than 50 mm. From 90 to 95 percent of the charge is ordinarily taken overhead. The side streams from this tower can be held to very narrow boiling ranges, making a closely heart cut product.

The redistilled stocks after being brought to S. A. E. grade are passed through a final finishing step to adjust them to proper color. See table 4.

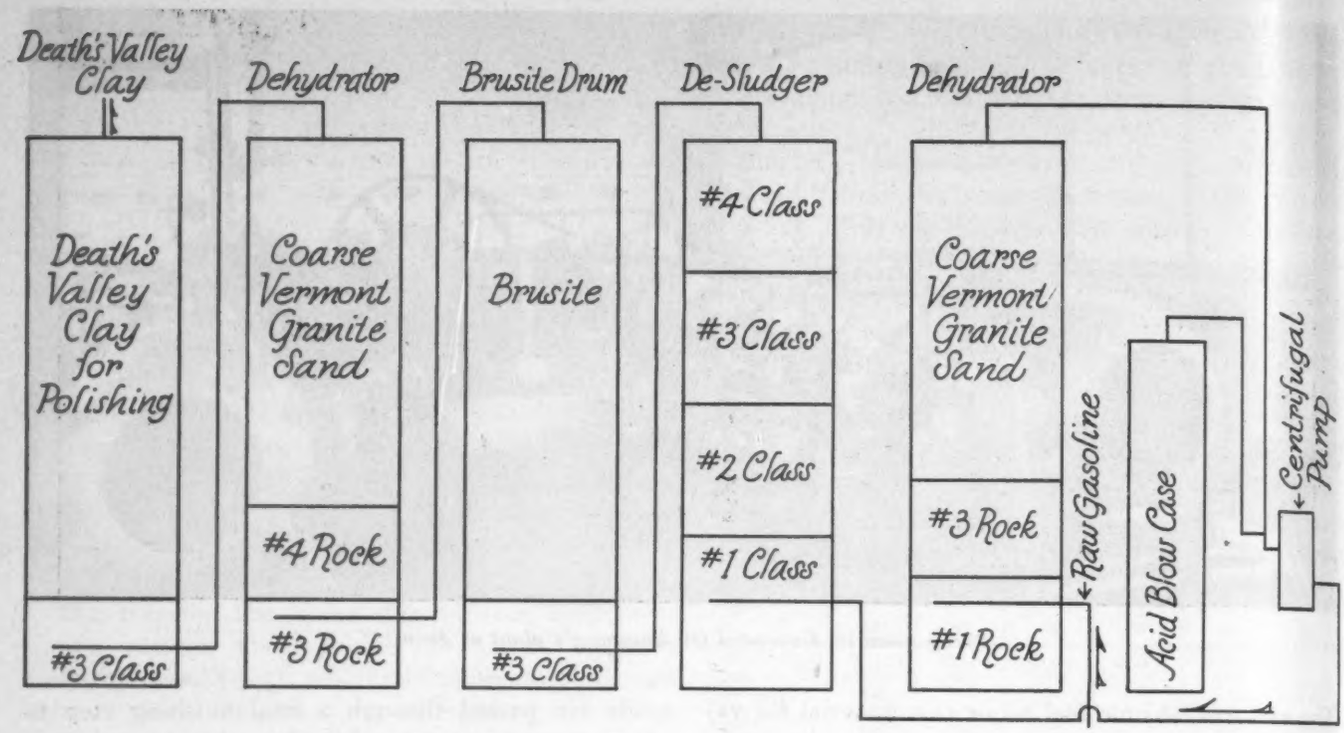
This process produces from the raw stocks used a close cut oil of exceptional quality and stability as shown by the tests given in Tables 4, 5, 6, and 7. The processing is subject at every step to the most rigid laboratory control and the finished products to regularly established service tests in order to guarantee their quality.

Associated Oil Company's continuous research and development program guarantees that the company will at all times keep in touch with every modern development and its progressive policy indicates that every major improvement suitable to its use will be promptly put into effect.

The motor oil is an illustration of a high quality product developed systematically and progressively. It is made from selected raw material, is closely heart cut, extremely stable, freed from non-lubricating constituents, of excellent appearance and gives remarkable performance as indicated by every type of laboratory, mechanical, motor or road performance test. (Properties of finished products and various performances are given in Tables 4, 5, 6 and 7.)



Instrument board in back seat of Sedan which is used as a consumer's laboratory.



Triangle Has Interesting Continuous Treating System

GASOLINE manufactured from crude coming from most of the fields in Southern California does not usually require treating for removal of hydrogen sulfide, except that made when processing at elevated temperatures and pressures, such as when cracking gas oil or topped crude.

Oil produced from the sands in Venice, or Playa del Rey, however, contains some hydrogen sulfide, and it is also present in the casinghead gas, which makes it necessary to treat the finished product and to use some chemical to prevent corrosion of reflux lines, vapor lines, condensers and de-watering tanks. The larger companies have installed elaborate systems used in treating, but the smaller concerns treat by various simple methods and with various chemicals. The principal agent used in sweetening and as a decolorizer is sulfuric acid. One of the average plants as to size and equipment used, employs a different method of obtaining the desired results by contacting and desludging with a finishing polish than that usually used in the Los Angeles Basin.

Triangle Oil & Refining Company, operating a plant east of Venice, with an allocated production of gasoline of about 600,000 of finished motor fuel per month, is operating a treating system which is interesting, both as to arrangement and operation. Crude produced from the Venice, or Playa del Rey zones is used almost exclusively, and is refined in a more or less conventional skimming plant. The plant consists of a pipe still retort, a preliminary flash chamber and a fractionating column.

The crude is first passed through the upper section of the vapor condenser by pumping with steam driven reciprocating pumps where it acts as a partial condensing agent, then is led through the topped crude bottoms to charge heat exchangers. From these units, the crude is flashed into the shorter column, from the base of which it is pumped through the pipe still for further heating. Heated to around 650° F., the oil is then admitted to the main column where separation and fractionation is completed.

The vapor line from both the flash drum and the main column are joined together so that the vapors from both towers are condensed in a common battery. Both columns are refluxed to prevent carry-over of hydrocarbons which will result in an end point too high for marketing. As the unit processes crude for the manufacture of gasoline, Diesel oil and topped crude, or fuel oil, the gasoline is the only product that requires treating for color, doctor sweetening and corrosion.

The gasoline condensed in the shell and tube units and received in the run tank has a color of about 15 Saybolt and contains some hydrogen sulfide. If con-

densation is permitted without some sort of treating, corrosion and consequent deterioration will set up in the condensers, run tank, de-watering tank and in the reflux lines leading back to the top of the columns. Most plants use a caustic solution with a comparatively high gravity to prevent hydrogen sulfide corrosion and excellent results are obtained. This company, however, uses caustic solution with a very low gravity, averaging about 1.5° Baume, which is also fed through the vapor line at about the same point that others use. The reason advanced in explanation of the use of the lower concentration, is that by using a weak solution, more liquid can be pumped to the vapor line thereby securing a better contact between the gasoline and the treating agent than if a higher concentration were used with a smaller volume. It is claimed also, that fewer burns have resulted from the use of a weak solution.

Liquid caustic is used in preparing the solution. A tank is set aside for this purpose, and when about to prepare a fresh batch of solution, a workman only needs to measure out a predetermined amount of liquid chemical and place it in the tank to secure a concentration of about 1.5° Baume.

The treating plant consists of five vertical tanks and an acid blow case. The first vertical unit is completely filled with rock, two sizes, and sand. The rock is designated as No. 1 rock and No. 3 rock. The sand is Vermont granite, coarse and uniform. About one fourth of the drum is filled with No. 1 rock and about as much of No. 3. The remainder is filled with the coarse granite sand. The purpose of this drum is its use in dehydrating the gasoline before it is contacted with the sulfuric acid.

The next in line is the blow case, and acid from it is introduced into the gasoline line at a point where it is connected with a flanged fitting to a motor driven centrifugal pump. This unit is used only to secure the proper turbulence needed in mixing and contacting the acid with the gasoline distillate. With an average treating, only about one eighth pound of acid is required per barrel of gasoline.

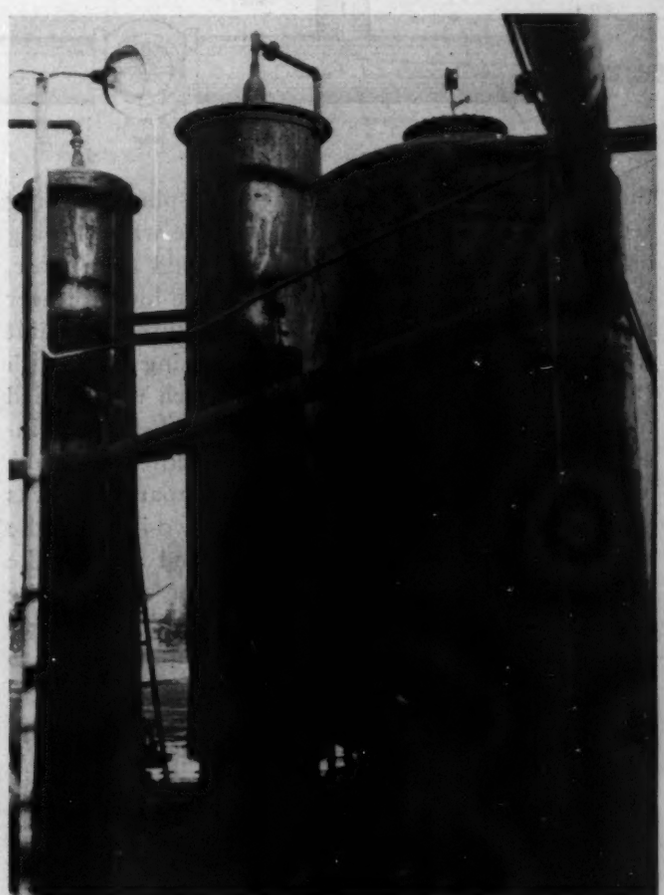
The next unit in line is the de-sludger drum. It is filled with about equal portions of broken glass, graded as No. 1, No. 2, No. 3 and No. 4. These are the commercial grades by which broken glass is classified in this territory. By forming a comparatively quiescent zone through which the gasoline travels, separation of the sludge from it is accomplished satisfactorily. According to the officials of the company, the drum should have a large diameter, while it is claimed the height does not affect the separation as much as the width.

Continuing through the system under the initial pump pressure, the gasoline enters the next drum in the system. It is filled to about one fourth of its capacity with No. 3 glass, upon which is placed manufactured Brusite, in preference to the natural mineral as mined. From this unit, the gasoline passes to the second dehydrating unit, filled to about one eighth of its capacity with No. 3 rock, another equal amount of No. 4 rock, while the remainder of the column is filled with Vermont granite sand of the same grade, as to size as that used in the first dehydrating unit.

The fifth, or polishing column has about one eighth of its interior filled with No. 3 glass, upon which is placed a sufficient amount of a Death's Valley clay to finish filling the drum. From this unit, the gasoline, sweet, non-corrosive and having a 30+ color enters the plant storage tanks ready for shipment.

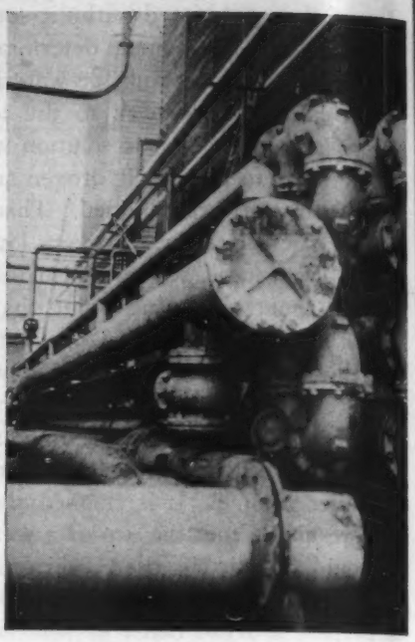
The lines entering each of the drums in the line of flow pass into the inside where they connect to inverted four-way perforated distributors. Perforated plates are also used in the drum containing the Brusite and Death Valley clay as an additional support above the other material. All drums are equipped with bleeder valves through which sediment and water are removed. The separated sludge from the de-sludging drum is drained away to a pit excavated for this purpose.

When the commercial Brusite has lost its effectiveness, it is regenerated by reversing the flow and using steam. By again reversing the flow, it is water washed and drained, after which it is ready to be placed on the line again with gasoline flowing through it. The system has been in operation one year and it is said to be almost automatic in its action, once the acid injection has been correctly proportioned to the amount of gasoline manufactured.



Treating columns and polishing vessel in continuous acid treating system.

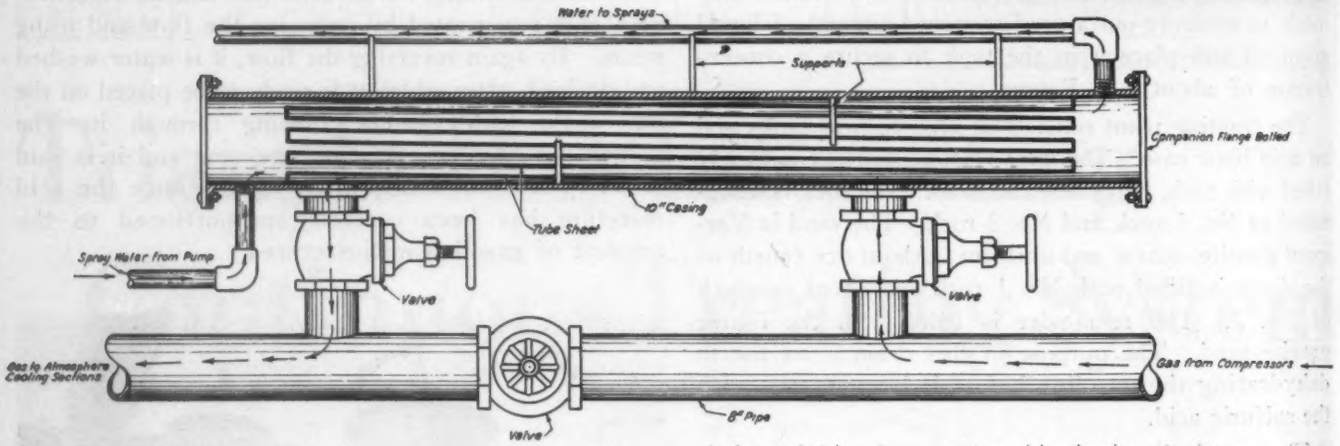
Gas-Water Exchanger



Gas-water exchanger at Gilmore Gasoline Company's Long Beach, California, plant.

IN a section where wind velocity is normally low, steam generated from water falling on the hot gas sections in the louvre tower prevented the desired circulation of air, bringing about a consequent higher temperature on the gas entering the absorbers than was desired for efficient operation. To overcome this situation, Gilmore Gasoline Company placed in operation a plant-designed and fabricated gas cooler and water heater in one of the plants at Long Beach, California.

In the previous operation of this plant, the gas was directed through an eight-inch line leading from the compressor scrubbers to the atmospheric cooling sections. The gas being hot, caused the water falling on the sections to evaporate rapidly and form scale, and the water vapor rising through the louvre tower prevented the necessary low temperature. The unit was made from a joint of ten-inch casing filled with two-inch pipes. One end of the two-inch was welded to a tube sheet, which was in turn welded to the inside of the casing. This was placed down the tube a sufficient distance that a small compartment was left at the end. The other end of the two-inch bundle was also welded to a tube sheet, and the bundle given a slight twist before securing the sheet to the other end of the ten-inch casing. This was done to prevent distortion and buckling of the bundle due to the difference in temperature in the casing and in the tube bundle.



The assembly was mounted on the original line, which had been prepared with a gate and two short risers. The assembly when in position formed the direct route of the gas, with the original line as a by-pass. Both ends of the tube bundle and casing were closed with companion flanges to secure ready access to the interior. The original water line leading from the spray pumps was connected to one end of the exchanger, and the other outlet, coming from the opposite end, led to the original spray connections.

By use of this unit, the temperature of the gas has been materially lowered, as well as removing the objectionable cloud of steam and water vapor which came from the hot atmospheric sections when operated in the original manner. The temperature of the cooling water has not been elevated to such an extent that evaporation is accelerated. By the time the water has descended through the breaker trays and distributing sections, the temperature is reduced to a satisfactory point.

Scale has not formed to an appreciable extent in the tube bundle, and the formation of scale on the hot gas sections has been partially eliminated. Altogether, it is said, operation of this unit is giving excellent service.

The cost of manufacture was comparatively low, because practically all of the materials were taken from surplus stores. Sufficient connections, gates and flanged unions were placed in both the gas and water lines to permit complete removal, if found necessary, without disturbing the operation of the plant.

Union Oil Company's

Debutanization of

Cracked Gasoline

UNION Oil Company of California, at its Los Angeles refinery is operating a complete fractionation unit for processing pressure distillate, cracked gasoline and natural gasoline.

The main column is 106 feet in height with an inside diameter of 66 inches. In order that the column might meet all specifications and tests of the A. S. M. E. Unfired Pressure Vessel Code, it was designed to operate not over 220 pounds per square inch. When it was constructed, the walls were made of steel one inch in thickness and fabricated by fusion welding. The column was designed to process either cracked gasoline or natural gasoline, or both as a blended feed. The construction of this column is such that when it is in operation, and a temperature gradient taken throughout the column, the correlation indicates that excellent fractionation is obtained on each bubble plate.

The feed charged to this column consists principally of pressure distillate, or cracked gasoline combined in varying proportions with natural gasoline produced in the fields adjacent to Los Angeles and/or absorption gasoline recovered from vapors taken from accumulator drums, run tanks and storage vessels within the refinery itself. In normal operation, the amount of raw unfractionated liquid charged to the debutanizing unit averages approximately 18,500 gallons per hour. The mixed material, the bulk of which is pressure distillate, or cracked gasoline—only a small percentage being vapor recovery gasoline—is passed to the processing unit by pumping it through suitable exchangers—cold charge against fractionator bottoms. Four of these interchangers were installed, arranged in pairs having a combined exchanger surface area of 5320 square feet.

The characteristics of the combined feed to the exchangers are as follows:

Methane, Percent Liquid Volume.....	....
Ethane	0.25
Propane	1.96
i-Butane	2.05
n-Butane	3.72
i-Pentane	2.93
n-Pentane	4.76
Heavier Fractions	84.33
Gravity, A. P. I.	50.80
Initial °F.	83
10% °F.	158
Recovery %	95.5
Vapor Pressure, Reid @ 100°F.....	10.0

Because of the rather high vapor pressure of the raw product, it was the desire of the company, when plans were being formulated leading to the fabrication of this unit, to reduce the material to a point where minimum losses would be obtained when treating. The original material, prior to fractionation could readily be treated, but through treating and subsequent handling, vaporization of the i-butanes and lighter hydrocarbons carried away with them, desirable n-butanes and heavier. It was also desired that a stabilized cracked product be produced that when blended with other desirable hydrocarbons in the preparation of a superior grade of gasoline, it would be of such a character that vapor locking would be entirely eliminated when the finished product was used in the consumers automobile.

Fractionation is carried out sufficiently that the lighter vapors, i-butane and lower boiling fractions, are carried upward in the vapor phase and discharged through the vapor line leading from the top of the column. Control of the characteristics of the separated vapors driven from the charge and removed as undesirable hydrocarbons is obtained, in part by pumping condensed overhead vapors back

to a convenient point as reflux. Characteristics of the reflux are as follows:

Methane, percent liquid volume	0.19
Ethane	4.08
Propane	28.68
i-Butane	17.08
n-Butane	49.97
i-Pentane and heavier	00.00
Total	100.00

Overhead vapors carrying the undesirable constituents of the raw feed are condensed in open type atmospheric sections in a louvre tower to a liquid temperature of 55°F. The liquid and vapors pass to an accumulator from which the non-condensable gases are removed through a regulating valve and passed to the plant lines for fuel. Liquids not utilized as reflux are passed through liquid level control instruments to pressure storage.

The processed bottoms fractionated to the desired composition are withdrawn from the base through a liquid level controller and passed through the twin banks of interchangers. Temperature of the liquid after being released through the exchangers is approximately 107°F. Further cooling is effected in atmospheric sections to a temperature of 76°F. from which the finished material is directed to proper storage. The characteristic of the finished gasoline, after debutanization are as follows:

i-Butane and lighter, % liquid volume	00.00
n-Butane	1.26
i-Pentane	2.63
n-Pentane	3.98
Heavier	92.13
Gravity A. P. I.	47.50
Initial °F.	122
10% °F.	184
Recovery %	98.00
Vapor pressure, Reid @ 100°F.	3.8

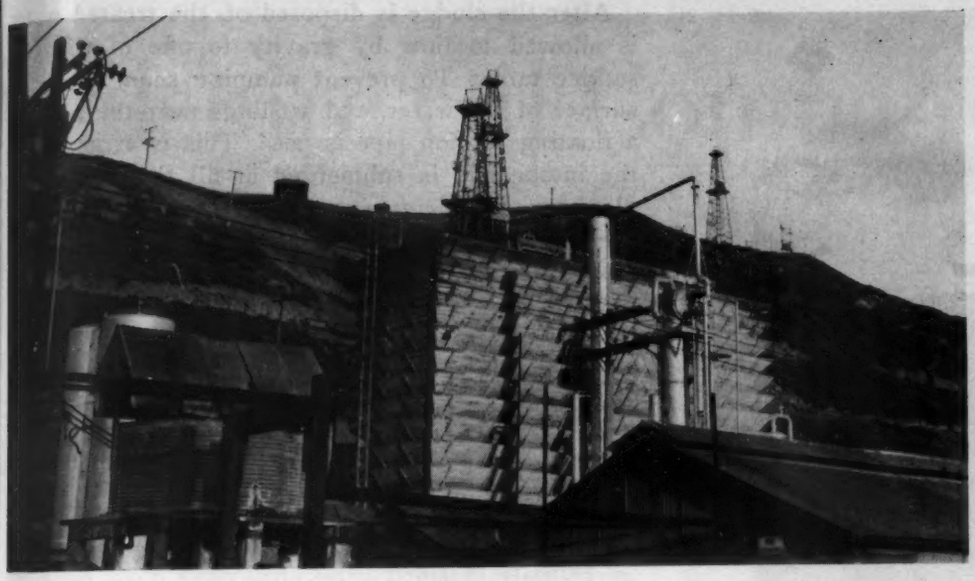
The interchangers, of which there are four sections, containing 2120 tubes per section, 16 gauge by ¾-inch O.D. by 42 inches in length made of Admiralty metal have an exchanger area of 1330 square feet per section. The tube sheets are welded integrally with the cast steel shells which prevents entrance to the chamber for cleaning purposes. The cold feed, which passes through the tubes, deposits a soft, porous, coke-like material which can be readily removed by drilling, even though the tube area may be restricted as much as 75 percent after 800 hours operation. The cleaning of the outer, or shell side of the non-removable tube bundle which handles the hot stabilized bottoms presented a more serious problem, since this deposit was sufficiently heavy to greatly reduce the over-all heat transfer when dirty. It has been found possible to keep the shell side of the tubes moderately clean by circulating a hot solution of detergent at a rate of about 80,000 gallons per hour for 48 hours, then water washing at the same high rate for two hours, finally injecting high pressure air into the incoming water stream for about four hours. If this procedure is followed after 400 hours service, it is found that the over-all heat transfer coefficient can be maintained satisfactorily. A permanent installation of the necessary drums, pumps and lines has been made to provide this cleaning operation.

After a period of operation which included 10,000 hours debutanizing cracked gasoline, a complete survey was made to determine the corrosion encountered in this stabilizer and accessories. No depreciation was found in the steel tower shell or in the hot lines. Severe pitting was discovered in the cold reflux system in the dewatering drum at the outlet of the reflux condenser and in the bottom of the reflux accumulator drum where water condensed and accumulated high concentrations of hydrogen sulfide.

The steel bleed valve on the dewatering drum required replacement after less than one month's service. This valve was replaced with an 18 percent chromium, eight percent nickel, swivel disc, globe valve, which has given excellent service for over six months. The cast iron headers in the reflux condenser atmospheric condenser sections showed about 0.1 inch of soft, porous corrosion, which is typical of graphitic corrosion of cast iron. It is proposed that these headers will be replaced with others made of cast steel or an alloy in the near future. The admiralty metal tubes in the reflux condenser, and finished bottoms cooler sections have shown no evidence of depreciation or hydrogen sulfide corrosion.

Full automatic control is obtained throughout the system by utilizing adequate instruments placed at the necessary points in the system. The arrangement of the unit and accessories is such that the control room is placed between the tubular heaters and the fractionating column, pumps and exchanger sections. Both indicating and recording instruments are mounted on a large panel in the control room, together with many thermocouples so the man on duty can control the entire range of operation from one point.

The data gathered from the operation of this unit show that with a column bottom temperature of 390 °F., and a process pressure of 124 pounds per square inch gauge, that a well stabilized bottom product can be produced with a vapor pressure of 3.8 pounds per square inch, Reid at 100°F. containing 1.2 percent by liquid volume of n-butane, with no lighter components. This operation is accomplished with a loss of 7.6 percent of the raw feed, which is an overhead gas containing no pentanes or heavier hydrocarbon fractions.



Coline Gasoline Corporation's gasoline plant in the Rincon field, Sea Cliff, California.

Corrosion and Water are Problems *at Rincon Plant*

AT Coline Gasoline Corporation's Sea Cliff gasoline plant in the Rincon field, ten miles up the coast from the Ventura, California, producing area, corrosion of plant service lines and reduction of the plant waters' scale forming tendencies offered real problems to the operating superintendent.

Soil conditions are such that corrosion is severe. A large percentage of alkaline matter is found in the soil naturally, which is aggravated by a condition that permits progressive accumulation and concentration of corrosive substances. A peculiar and unusual situation is present in that when rainfall is most abundant, the water from which the plant supply is taken becomes more heavily laden with scale-forming solids in solution. Water falling on the slopes of the hills and palisades back of the plant dissolves the corrosive and scale forming compounds and washes them down to the level land near the surf where they soak into the ground. Because of this condition the plant service lines in the soil corrode quickly, and the water, coming from wells and reservoirs nearby, contains a large amount of minerals. The raw water at the plant has the following analysis:

	Grains per gallon
Silica	2.405
Oxides of iron and aluminum	0.040
Carbonate of lime	15.046
Sulphate of lime	20.837
Carbonate of magnesia	21.694
Sodium and potassium sulphates	58.507
Sodium and potassium chlorides	19.040
Sodium and potassium nitrates	Trace
Loss, etc.	0.223
Total soluble mineral solids	137.792
Total soluble incrusting solids	60.022
Total soluble non-incrusting solids	77.770

This quickly changes to the following condition when the water is circulated in the louvre tower:

Silica	9.811
Oxides of iron and aluminum	0.163
Carbonate of lime	Trace
Sulphate of lime	91.337
Carbonate of magnesia	35.200
Sulphate of magnesia	402.852
Sodium and potassium sulphates	1760.044
Sodium and potassium chlorides	421.600
Sodium and potassium nitrates	Trace
Loss, etc.	0.333
Total soluble mineral solids	2721.440
Total soluble incrusting solids	539.363
Total soluble non-incrusting solids	2181.977
Pounds soluble incrusting and non-incrusting solids	388.78 lbs. gal.

Several methods have been suggested which are recommended to diminish the scaling effect of this water, especially that from which steam is generated.

In erecting the water treating plant the operators took advantage of the hillside to secure gravity flow through the system.

The method finally adopted included lime and soda treatment with a small amount of sodium aluminate. Three 10,000-gallon tanks were set on a location just behind the plant, which is just under the row of foot-hills bordering the coast, so that one tank is behind and above the other two.

Water from all condensate tanks and that produced and pumped from impounding reservoirs is placed in the upper tank without regard to the percentage of condensed steam water in the batch about to be treated. The amount recovered from this source is fairly constant and the formula which has been selected for treating does not need to be changed because of this. The upper tank, in which the treating is done is filled each day and a slurry of 160 pounds of lime, 180 pounds of soda ash and two pounds of sodium aluminate is pumped in. Each of the chemicals is weighed out carefully and dumped into a small mixing tank near the chemical storage room and mixed with sufficient water so that it can be easily pumped.

After the batch has been prepared, gas is turned into the large tank, distributed across the floor through a series of perforated spiders. This method of agitation has been found satisfactory. It is continued for about 15 minutes at about 15 minute intervals during the following 24 hours. The batch is then permitted to settle, which is carried on fairly rapidly, and the sludge is drained away and pumped to a disposal pit near the tanks.

After the sludge is disposed of, the treated water is allowed to flow by gravity to one of the two service tanks. To prevent pumping scum from the surface of the water, and settlings near the bottom, a floating suction pipe is used. This is arranged so the intake end is submerged at all times, and the plant operator determines when sufficient water has been removed without danger of taking suction on the bottom water.

With the above method of treating the water, the condition is as shown below:

TREATED WATER ANALYSIS

	Grains per gallon
Silica	0.397
Oxides of iron and aluminum	0.070
Carbonate of lime	0.817
Sulphate of lime	None
Carbonate of magnesia	0.353
Sodium and potassium sulphates	13.040
Sodium and potassium chlorides	2.040
Sodium and potassium carbonates	21.380
Sodium and potassium nitrates	Trace
Loss, etc.	0.096
Total soluble mineral solids	38.193
Organic matter	Trace
Suspended matter	1.284
Total soluble incrusting solids	1.637
Total soluble non-incrusting solids	36.556

The water has shown all indications of good service since the treatment was selected and the boiler flues are only slightly incrusted. The boilers are blown down regularly, and are taken from the line and washed on an average of once each three weeks.

CORROSION

The plant service lines which are under ground began to show indications of deterioration in a few months after the plant was placed in operation, and it was a continuous round of repair and replacement after that. About a year ago the lines were uncovered, cleaned by scraping and new sections installed where severe pitting occurred. A primer coat of pipe line grease was first applied—after which the regulation coat of heavier material of that class was put on. A grease saturated wrapper was next placed around the pipe, after which the fourth coat was used. This was of the same character and consistency as the second; and a finish paper wrap was affixed for soil stress protection.

Since these two methods of plant protection were adopted, neither the plant service lines nor the water has caused further difficulty. John Black, superintendent of the gasoline plant, in aiding in the presentation of the foregoing material expressed the opinion that although there may be few localities which show such severe cases of water trouble and soil corrosion, there may be however, some other operators who might profit by his experiences.

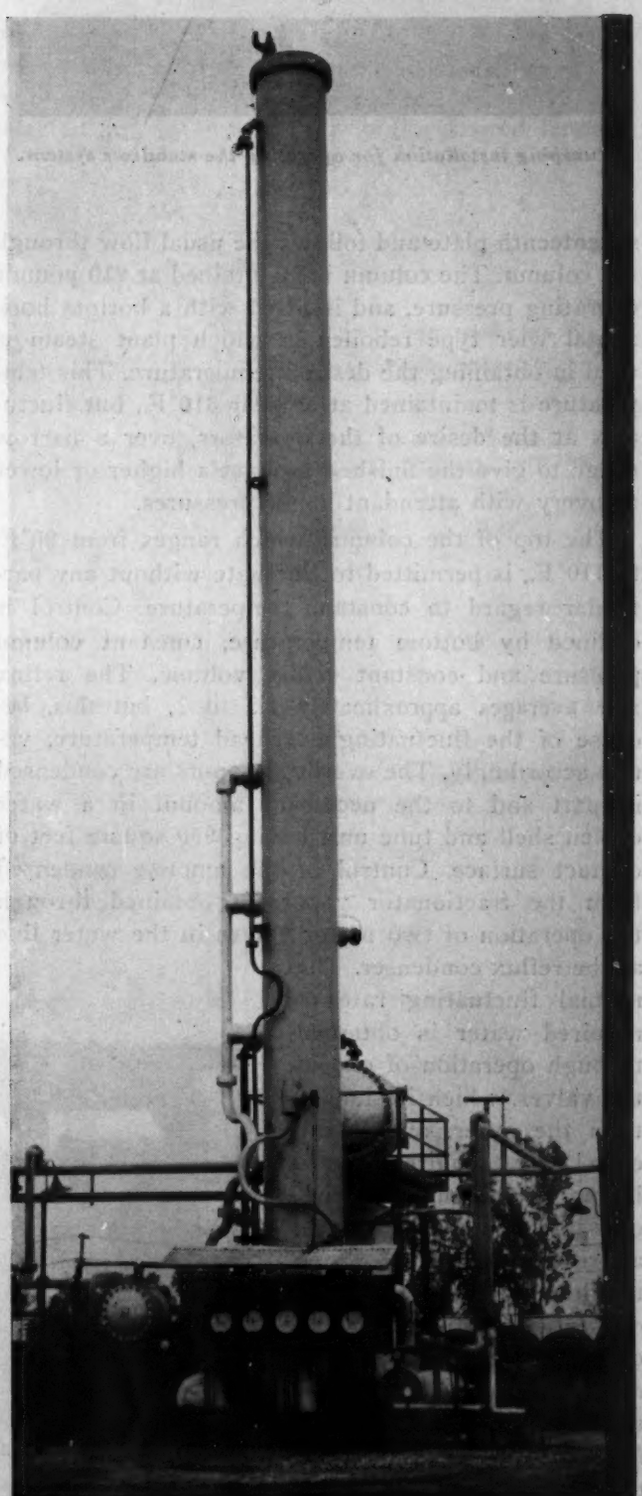
Wilshire Oil Company's High Pressure Rectifier . . .

UNTIL a short time ago, Wilshire Oil Company had been processing natural gasoline at Santa Fe Springs through a low pressure rectifying column with results that were not altogether satisfactory. The plant production, calculated on a gallonage basis, was about 1.9 gallons per thousand cubic feet of gas processed through the absorbers. Finished gasoline, from the base of the kettle of the older type fractionator, averaged about 25,000 gallons, having a recovery of 89 percent and containing approximately 2.5 percent propane.

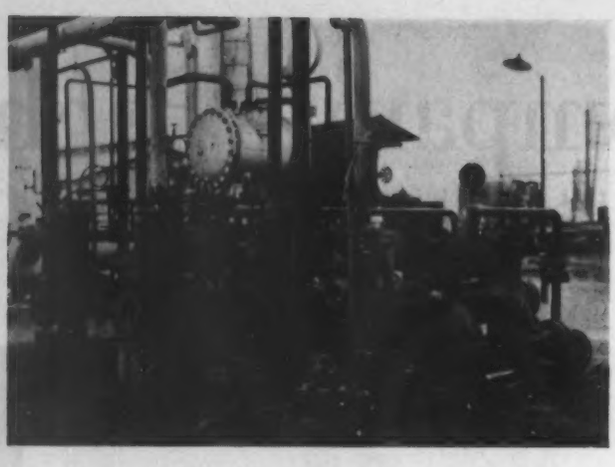
Because of changed marketing conditions and the desire to improve the over-all plant yield, a high pressure fractionating unit has been installed. Since it was placed in operation, the plant recovery has been increased from 1.90 to 2.00 gallons, with a finished product from the base of the column having an Engler distillation recovery of 93 percent, and containing a negligible amount of propane.

The new unit was built by Foster-Wheeler Corporation and contains the usual auxiliary equipment in addition to a column 36 inches in diameter by 62 feet in height, fitted with 40 plates. The absorption plant production is fed to this column by a close-clearance feed pump under an operating pressure of 210 pounds gauge, which remains constant throughout the operating cycle. Re-compressor gasoline, originating at storage tanks and absorption accumulator drums, is produced under a pressure of 260 pounds and accumulated in an auxiliary drum from which the liquid passes through a liquid level controller to the discharge line of the column charging pump. The composite feed passes through two exchangers, the first of which is compressor-vapor-to-charge, and the second stabilizer bottoms-to-feed. The vapors taken from the storage tanks and accumulator drums are compressed to 260 pounds and piped while hot to the first of these exchangers, after which they are cooled and the available gasoline condensed and trapped in the accumulator drum.

This composite feed, absorption and liquefied compressor gasoline is placed in the column above the



Wilshire Oil Company's stabilizer system at Santa Fe Springs, California.



Pumping installation for operating the stabilizer system.

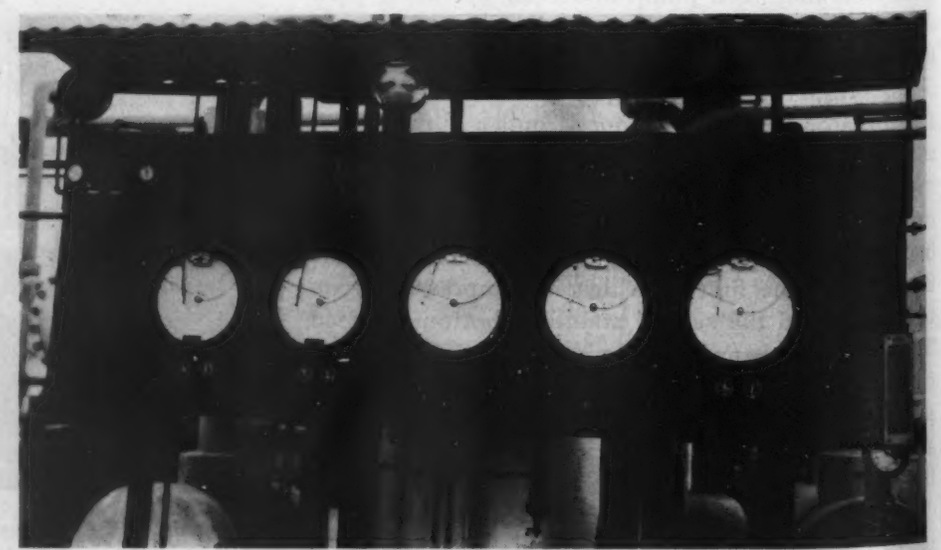
seventeenth plate and follows the usual flow through the column. The column is maintained at 210 pounds operating pressure, and is fitted with a bottom horizontal wier type reboiler in which plant steam is used in obtaining the desired temperature. This temperature is maintained at or near 310°F., but fluctuates at the desire of the operators, over a narrow range to give the finished product a higher or lower recovery with attendant vapor pressures.

The top of the column, which ranges from 90°F. to 110°F., is permitted to fluctuate without any particular regard to constant temperature. Control is obained by bottom temperature, constant column pressure and constant reflux volume. The reflux rate averages approximately 2.5 to 1, but this, because of the fluctuating overhead temperature, varies accordingly. The overhead vapors are condensed in part and to the necessary amount in a water cooled shell and tube unit having 950 square feet of contact surface. Control of the amount condensed from the fractionator vapors is obtained through the operation of two motor valves in the water line at the reflux condenser. The normal fluctuating rate of required water is obtained through operation of one of the valves, which is smaller than the other, and if the cooling requirement is larger, the second valve begins to function and permits a greater amount of water to flow through the condenser. Because of the changing temperature of the reflux, a cooler is placed on the discharge line leading from the reflux pump to the top of the column so that a more constant temperature may be maintained.

A complete set of temperature and rate-of-flow controls are attached to the unit—which, when once adjusted for the desired operating conditions and finished gasoline characteristics and composition, require a minimum amount of attention. Two back pressure controls are placed on the vapor line from the top of the column, one in the line proper, and the other on the line from the top of the reflux accumulator drum. The first is adjusted to maintain a required constant operating pressure of 210 pounds gauge, while the second, on the line from the accumulator drum, is set at 190 pounds. This differential in pressure was established so that the top column pressure would remain constant and at the point desired for efficient operation, and yet permit the pressure on the reflux accumulator drum to fluctuate over a comparatively wide range because of the variation in atmospheric temperature, the required condensation rate and liquid temperature.

The absorption plant is operated on a large amount of recycled gas, resulting from gas lift operations in the production side of the field, and the gasoline manufactured contains, because of this factor, considerable lower boiling hydrocarbons. Because of the characteristics of the fractionator feed, cast iron rings cut rapidly in the fluid end of the feed pumps. The type of packing originally installed was designed to handle a gasoline containing a normal amount of lower boiling fractions, and under the conditions at this plant, it was changed. Instead of the cast iron snap rings, the pumps were fitted with ordinary hydraulic packing, placed three rings to the groove, which has given satisfactory service. The pumps do not require repacking more than once each six months, according to Louis Seppi, plant superintendent.

Control instruments for regulation of stabilizer unit.

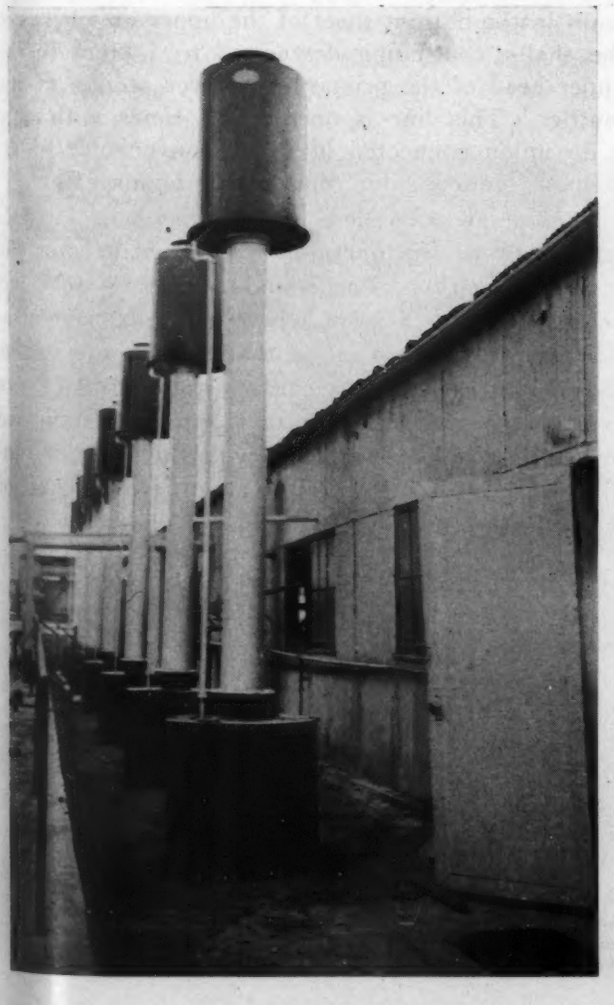


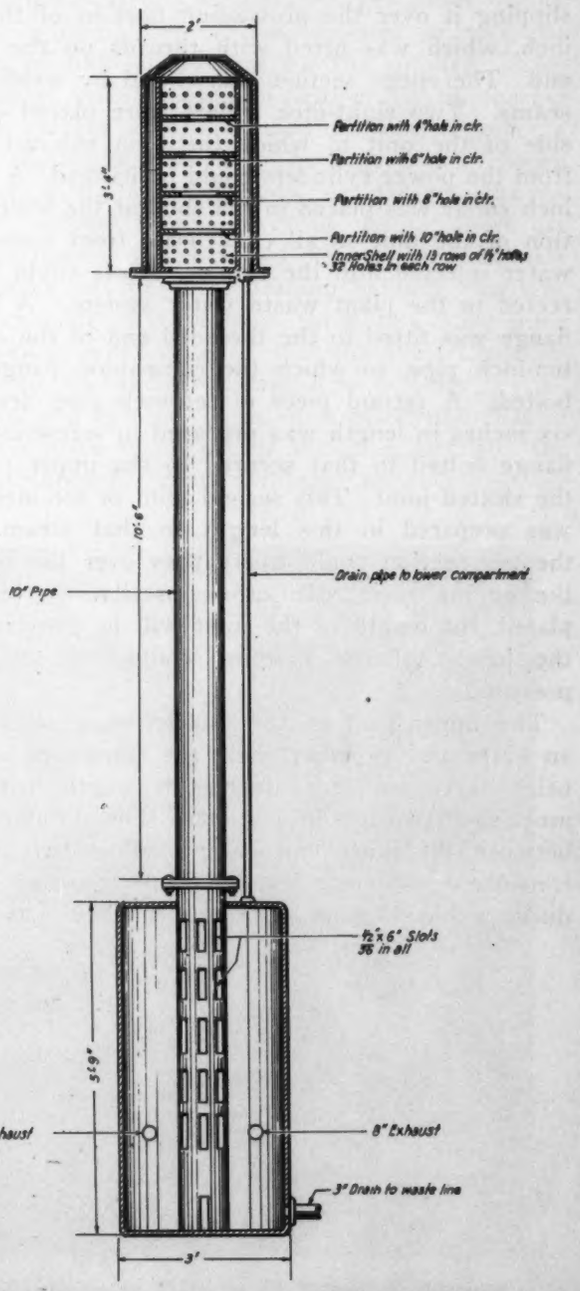
Silent Exhaust Mufflers

WITH a gasoline plant located almost in the heart of a residential district in Long Beach, California, Gilmore Gasoline Company found it expedient to build a series of exhaust stacks and mufflers which would not only have a high efficiency, but would also reduce the sound of the exhaust so no objections would be registered by residents near the plant.

The company has seven 200-horsepower gas engine-driven compressors in this plant, and an installation of a complete set of mufflers for these engines has been fabricated and placed in position. The original battery of mufflers were made of concrete, but after several years use and following the severe earthquake about two years ago, they failed because of cracking at various points and subsequent disintegration.

Practically all of the material entering into the construction of these new mufflers was salvaged from obsolete material removed from service in the plant when it was modernized a few years ago. An old style fractionator three feet in diameter was selected and by cutting it into the desired lengths,




2'
Partition with 4" hole in ctr.
Partition with 6" hole in ctr.
Partition with 8" hole in ctr.
Partition with 10" hole in ctr.
Inner Shell with 13 rows of ½" holes 32 holes in each row
3'-4"
10'-6"
10" Pipe
Drain pipe to lower compartment
½" x 6" Slots 36 in all
5'-9"
8" Exhaust
8" Exhaust
3" Drain to waste line
3'

Efficient and noiseless exhaust mufflers fabricated of salvaged materials. Gilmore Gasoline Company, Long Beach, California.

sufficient pieces could be obtained to form the base receivers for the exhaust gases. These pieces were cut from the original column to form cylinders five feet nine inches in length, to which heavy sheet steel was welded so as to make a solid cover for the lower end. Sheets of similar material were prepared and welded to the upper head after a piece of ten-inch pipe was secured to the lower cover in the exact center. This joint of pipe was prepared by slotting at regular intervals, piercing it with five rows of half-inch by six-inch slots. Two slots with the same dimensions were cut in the extreme lower end to provide a drain for moisture; in all, the slots numbered 32 to the joint when completed.

After the slotted joint of ten-inch pipe was welded in position, the top cover was placed in position by slipping it over the protruding portion of the ten-inch, which was fitted with threads on the upper end. The entire section was closed by welding all seams. Two eight-inch collars were placed on the side of the unit to which the twin exhaust pipes from the power cylinders could be flanged. A three-inch collar was placed in the shell at the lower portion of the unit so all condensate from steam and water injected into the exhaust stools could be directed to the plant waste water system. A bolted flange was fitted to the threaded end of the slotted ten-inch pipe, to which the companion flange was bolted. A second piece of ten-inch pipe, ten feet, six inches in length was prepared to screw into the flange bolted to that secured to the upper part of the slotted joint. This second joint of ten-inch pipe was prepared in this length so that steam from the top section could easily pass over the roof of the engine room. In other installations contemplated, the length of the joint will be governed by the height of the building containing the compressors.

The upper part of the muffler was made with an outer and an inner shell, the completed section being three feet, four inches in length, with the inner shell two feet in diameter. The annular space between the inner and outer shell is two inches, considered sufficient for the proper passage of reduced exhaust gases. The inner shell was fitted with five horizontal partitions with holes cut in the center of each, graduating in size from ten inches in the lower partition to four inches in the upper. Each compartment formed by these partitions has half-inch holes bored, or cut by an acetelyne torch, through the walls of the shell. A total of 13 rows of these holes were placed in the shell, with a total of 406 in each unit.

In addition to the large number of small holes bored in the shell of the inner chamber, four triangular ports were cut; two of which were placed in the compartment above the bottom section, and two through the walls of the compartment in the third section. This was done to secure an additional free passage of reduced exhaust gases, and to prevent a possible back pressure on the power cylinders of the compressors. The inner and outer shell of the upper unit were secured to a flat steel base in such a manner that the gases must pass from the inner to the outer shell before being released to the atmosphere. The inner shell was completed with a flat top, not connected to the outer shell. The completed unit was welded to the plain end of the ten-inch pipe extension, and erected above the base, or primary muffler section.

To provide a drain for all condensate caused by steam passing from the inner compartment to the outer, a three quarter-inch line was connected to a point in the bottom sheet of the upper unit between the shells, continuing downward to a point in the upper head of the primary, or lower section of the muffler. This line is open at all times with only a lip union connected in it for convenience of attaching, removing for replacement or inspection.

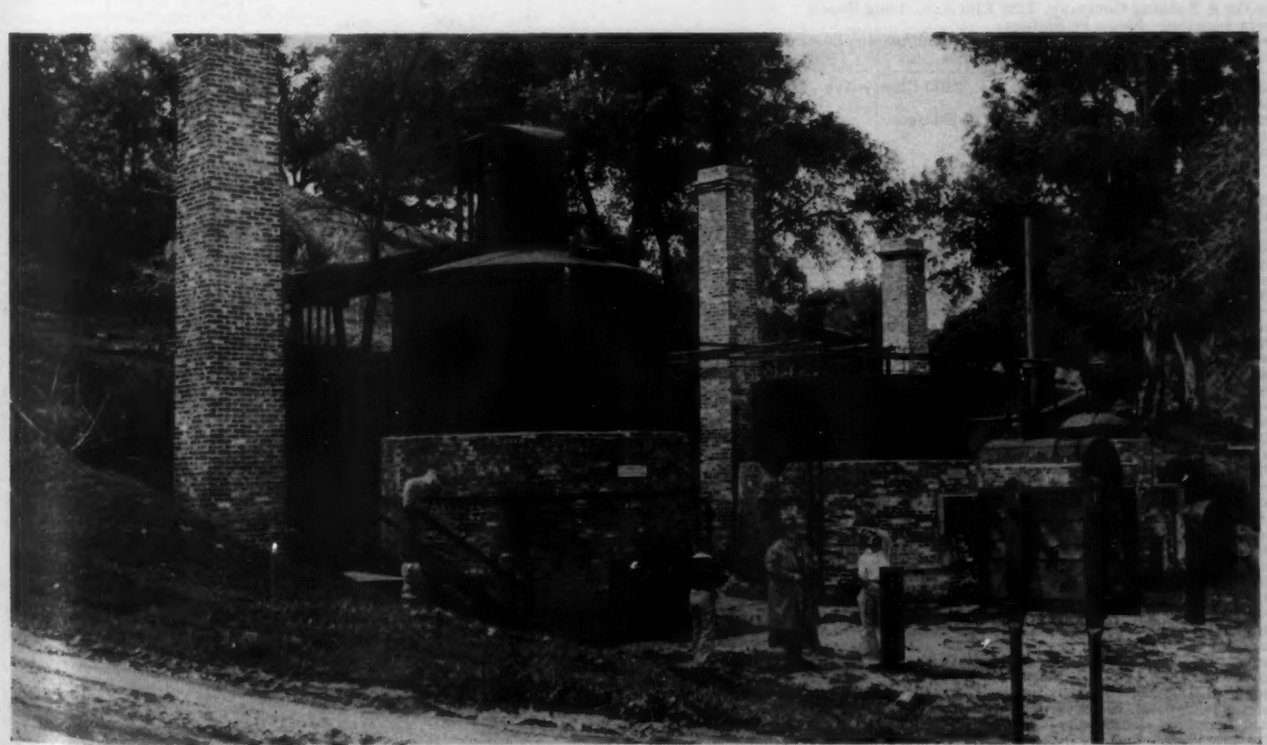
The operation of these mufflers has been satisfactory, both to the operators of the plant and the residents nearby. The sound of the exhaust has been reduced to a point where a normal conversation may be carried on at that side of the engine room without difficulty. Back-pressure does not exist to an appreciable extent; pressure indicated by a "U" gauge shows that with the engines running with a full load only about two inches of water is shown on the reading.

Analysis of California's Refining and Natural Gasoline Industry

GEORGE REID

ANALYSIS of available information indicates that the refining and natural gasoline manufacturing industries in California are composed of 55 operating companies in the refining branch and 40 companies in the natural gasoline phase of the business. Of the refining companies, 17 are engaged in gasoline manufacture. Through the operation of the various properties under present economic conditions, California is producing around 100,000 barrels daily of straight-run products, 50,000 barrels of cracked gasoline and averaging 35,000 barrels of natural gasoline daily. This amounts to a total of 185,000 barrels daily of products falling into the motor fuel range. The refining branch, during recent months has been operating at about 57 percent of rated capacity, and the natural gasoline plants at less than half capacity.

Capacity of refineries in this area, according to weekly statistics of the American Petroleum Institute, is 852,000 barrels, which is approximately 22 percent of the total capacity for the United States. In potential rate California is the largest refining district in the country but in total crude runs to stills it takes third place. California charges about 450,000 barrels of crude daily to its refineries, or about 16 percent of total crude runs for the country. Texas Gulf Coast, with capacity of 617,000 barrels charges 569,000 barrels daily, according to June 15 reports, and is the leading district. The East Coast refining district, with rated capacity of 612,000 barrels, charges 467,000 barrels of crude daily. These are average figures and intended only to show relative importance of the three leading refining districts. They indicate that perhaps there has been some justification in the criticism that the West Coast refining district has been overbuilt in capacity beyond all need and to this condition is attributed that of repeated price wars within the area and the too frequent need for relief for piled up excess motor



Near Newhall, California, Scott & Wood built the first practical refinery in 1876. In 1879 Scott & Morrison built a "more modern" refinery, which is still standing, reconditioned, as shown in the photograph. The plant was known as California Star Oil Works Company, one of the predecessors of Standard Oil Company of California which concern is preserving the old plant.

TABLE 1

Refining Companies, Location of Plants and Capacity, in California

COMPANY	Crude Capacity	Type	CRACKING	
			Capacity	Type
Ajax Oil & Refining Company, 811 West 7th St., Los Angeles Plant Location—East Compton Blvd., Clearwater Superintendent—P. A. Lawler	3,000	skim		
American Oil & Refining Company, 5776 Cherry Ave., Long Beach Plant Location—Hynes Superintendent—A. C. Mayrowitz, General Manager	1,500	skim		
Associated Oil Company, 79 New Montgomery St., San Francisco Plant Location—Avon Refinery, Associated, Calif General Superintendent—Wm. P. Hugo Asst. Gen. Supt.—T. O. Edwards, Jr. Chief Engineer—H. B. Haney Chief Chemist—L. Mittleman	52,000	skim	21,000	Tube and Tank
Plant Location—Watson Refinery, Wilmington General Superintendent—F. E. Coyle Superintendent—Frank Harris Chief Chemist—E. J. Lange Research Chemist—Dr. Arthur Lazar	9,500	top[1]		
Bachman Petroleum Corporation, 1841 East 29th St., Long Beach Plant Location—Long Beach Superintendent—C. S. Cox	2,500	skim		
Bell View Oil Syndicate, 526 Richfield Building, Los Angeles Plant Location—Santa Fe Springs	2,500	skim		
B. & F. Oil & Refining Company, Culver City Plant Location—Venice Superintendent—H. H. Biber	2,000	skim		
R. R. Bush Oil Company, 2790 Cherry Ave., Long Beach Plant Location—Long Beach General Manager—W. H. Morgan Superintendent—W. E. Snowden Chief Chemist—F. S. Besser Chief Engineer—R. B. Rubottom	3,500	skim		
The Caminol Company, Ltd., 112 West 9th St., Los Angeles Plant Location—Santa Fe Springs General Superintendent—R. C. Colvin Superintendent—Dave Lewis Chief Engineer—R. C. Colvin Chief Chemist—S. J. Garrett	3,500	skim		
Plant Location—Hanford Superintendent—C. L. Davies	2,500	skim		
Capitol Crude Oil Company, 1020 Subway Terminal Bldg., Los Angeles Plant Location—Santa Paula President—E. P. Clark	160	skim		
The Casmite Company, 111 West 7th St., Los Angeles Plant Location—Casmalia Superintendent—Ray T. Kemper	1,000	asph.		
Eagle Oil & Refining Company, 3328 Elm Ave., Long Beach Plant Location—Santa Fe Springs President and General Manager—E. A. Edminston Superintendent and Chemist—D. C. Cook	2,000	skim		
Edington Oil & Refining Company, Ltd., 2800 Cherry Ave., Long Beach Plant Location—Long Beach President and General Manager—C. B. Edington Superintendent—L. A. Foulger Chief Chemist—H. H. Rathron	3,000	skim		
Elm Oil Company, 3328 Elm Ave., Long Beach Plant Location—Long Beach President and Manager—Fred Stiener	1,500	skim		
Envoy Petroleum Company, 3000 Walnut St., Long Beach Plant Location—Long Beach Superintendent—Wm. F. Emery Asst. Supt. and Chief Chemist—W. A. Shaffer	3,000	skim		
Estado Petroleum Corporation, Ltd., 1315 East Hill St., Long Beach Plant Location—Long Beach General Superintendent—E. E. Greiner Assistant Superintendent—T. G. Stickels Chief Chemist—Stanley A. Blocker	6,000	skim		
Exeter Refining Company, 5843 Paramount Blvd., Long Beach Plant Location—Hynes Superintendent—N. F. Gallucci Chief Chemist—John Klein	10,000	skim & asph.		
General Petroleum Corporation of California, 108 West 2nd, Los Angeles (Socony-Vacuum Oil Corporation) Plant Location—Vernon and Torrance[2] Superintendent—Fred Isaacs (both plants) Chief Chemist—G. F. Olsen	65,000	skim	6,000	Kellogg
Plant Location—Lebec Superintendent—R. C. Wheeler	12,000	top		
Gilmore Oil Company, Ltd., 2423 East 28th St., Los Angeles Plant Location—Los Angeles Manager Refineries—H. L. Eggleston Superintendent—H. E. Marsh Technical Engineer—E. L. Saunders Chief Chemist—R. N. Pierson	1,500	skim & asph.		
Plant Location—Roadamite Superintendent—Perry Vandervoort	700	skim & asph.		
Golden Bear Oil Company, Ltd., 702 Union Bank Bldg., Los Angeles Plant Location—Bakersfield (Oildale) Superintendent—E. L. James	500	asph.		

TABLE 1

Refining Companies, Location of Plants and Capacity, in California—Continued

COMPANY	Crude Capacity	Type	CRACKING Capacity	CRACKING Type
Hancock Oil Company of California, 2828 Junipero St., Long Beach Plant Location—Long Beach General Superintendent—George D. Williams Superintendent—H. D. Tupper Design Engineer—W. T. Hancock Chief Chemist—La Verne Smith	15,000	skim	1,500	Hancock
Harbor Refining Company, 2240 South St., Long Beach Plant Location—Long Beach Superintendent—H. A. McOwen	2,000	skim		
Interstate Oil Company, 390 I. W. Hellman Bldg., Los Angeles Plant Location—Taft	250	skim		
Italo Petroleum Corporation of America, 391 Sutter St., San Francisco Plant Location—Long Beach (Plant operated by Super Asphalt Products Company, 2990 Pine Ave., Long Beach)	1,500	asph.		
Kolingo Refining Company, Coalinga Plant Location—Coalinga	250	lube		
Lake View Oil & Refining Company, 513 Edwards & Wildey Bldg., Los Angeles Plant Location—Box 669, Maricopa General Superintendent—F. T. Fisher Superintendent—C. Dower Chief Chemist—Linden Ballou	3,000	skim		
Los Angeles Refining Company, 4037 Bandini Blvd., Los Angeles Plant Location—Bandini Blvd., Los Angeles General Manager—Glenn Dies Superintendent—Jim Prince Chief Chemist—A. L. Lord	2,500	skim		
MacMillan Petroleum Corporation, 530 West 6th St., Los Angeles Plant Location—Signal Hill (Long Beach) Refinery Manager—H. E. Boner Superintendent (Signal Hill)—C. C. Benz Chief Engineer—C. C. Benz Chief Chemist—S. E. Campbell Plant Chemist—L. E. Everett	7,500	skim		
M. M. McCallen Refining & Producing Company, 17th and Garfield Sts., Huntington Beach Plant Location—Huntington Beach Owner—M. M. McCallen Superintendent—P. L. Davis Chief Chemist—Roy Seabridge	1,200	skim & asph.		
Mohawk Petroleum Company, 806 Financial Center Bldg., San Francisco Plant Location—Fruitvale (Bakersfield) General Superintendent—J. A. Robinson Superintendent—E. L. Rogers	3,500	skim	6,500	Own, Bldg.
Monarch Refineries, Ltd., 820 Detwiler Bldg., Los Angeles Plant Location—Venice (Playa del Rey) Plant Location—Long Beach President and General Manager—C. W. Fourl General Superintendent—Frank McGee	3,000 3,500	skim skim		
Norwalk Company, 634 South Spring St., Los Angeles Plant Location—Maricopa General Superintendent—Jack Brennan Superintendent—Loren F. Moore Assistant Superintendent—Herbert F. Ball Chief Chemist—H. F. Ball Refinery Engineer—Ken Ritchie	4,000	skim		
Olympic Refining Company, 2425 California Ave., Long Beach Plant Location—Long Beach President—C. P. Ritter General Manager—P. E. Johnson Superintendent—Harry W. Batcher Technician—Niel F. Blaine Chief Chemist—A. H. Winther	6,500	skim		
Operators Oil Company, 1203 Garfield Bldg., 8th and Hill Sts., Los Angeles Plant Location—2208 East South St., Long Beach Owner—Henry Brown Superintendent—W. H. Redmond	1,500	skim		
Paraffine Companies, Inc., 475 Brennan St., San Francisco Plant Location—Emeryville General Manager—W. H. Lowe Superintendent—George Prifold, Sr. Chief Engineer—J. T. Coleman Chief Chemist—C. H. Robertson	1,200	asph.		
Petrol Corporation, 4020 Bandini Blvd., Los Angeles Plant Location—Bandini Blvd., Los Angeles General Superintendent—George F. Miller Assistant Superintendent—Norman Tyacke Chief Chemist—Ralph Tarshis	7,000	skim & asph.		
Rice Ranch Oil Company, 262 South Los Angeles St., Los Angeles Plant Location—Santa Maria Superintendent—George E. Holmes Assistant Superintendent—Byron Billington Chief Engineer—Reed W. Garman	600	skim	600	Clark
Richfield Oil Company of California, 555 S. Flower St., Los Angeles Plant Location—Bakersfield Plant Location—Hynes Plant Location—Watson General Superintendent—A. M. Kelly Superintendent—R. A. Panero Superintendent (Cracking)—W. R. Davis Chief Engineer—David E. Day Chief Chemist—C. K. Hewes Evaluation Engineer—Geo. T. Leslie	2,000[3] 4,000[3] 40,000	skim skim comp.	14,000 16,000	Cross Black

(Continued on page 366)

TABLE 1

Refining Companies, Location of Plants and Capacity, in California—Continued

COMPANY	Crude Capacity	Type	CRACKING Capacity	CRACKING Type
Rio Grande Oil Company, 417 South Hill St., Los Angeles (Consolidated Oil Corporation) Plant Location—Vinvale (Downey) General Superintendent—J. J. Downey Superintendent—Wm. Murray Chief Chemist—M. Bach Chief Engineer—W. C. Farquhar	10,000	skim	3,500	Sincl.
San Fernando Refining Company, Box 1, San Fernando Plant Location—Newhall Superintendent—Wm. D. Parks Assistant Superintendent and Chemist—L. D. Harworth	2,000	skim & asph.		
Seal Beach Refining Company, 500 Coast Highway, Long Beach Plant Location—Seal Beach Superintendent—Jack Milliff	2,500	skim		
Seaside Oil Company, Summerland Plant Location—Summerland Plant Location—Ventura Superintendent—D. C. Peet Engineer—S. A. Darrow Chemist—C. W. Heithwood Superintendent—Don E. Searles (Summerland)	500[3] 5,000	asph. skim & asph.		
Shell Oil Company, 100 Bush St., San Francisco Plant Location—Martinez Plant Location—Coalinga Superintendent—D. M. Day Assistant Superintendent—D. F. Purdy (Coalinga) Technologist—E. N. Klemgard Plant Location—Dominguez Plant Location—Wilmington Superintendent—C. O. F. Jenkins Assistant Superintendent—W. S. Nix (Dominguez) Chief Engineer—N. W. Thompson Assistant Chief Engineer—R. A. Lind Corrosion Engineer—S. M. Gregory Chief Chemist—C. H. Britten	16,700 3,800 55,000	skim skim skim	21,800 34,800 18,400	Dubbs[4] Dubbs Dubbs
Signal Oil & Gas Company of California, 811 West 7th St., Los Angeles Plant Location—Hynes Manager Gas Department—R. W. Heath Chief Engineer—C. L. Young	6,000[3]	skim		
Socal Oil & Refining Company, 1002 Rowan Bldg., Los Angeles Plant Location—Huntington Beach Superintendent—J. H. Grimes Chief Chemist—E. T. Carlton	3,000	skim		
Standard Gasoline Company, 225 Bush St., San Francisco Plant Location—Taft Distillation Superintendent—Elmo Fullmer	1,500	skim		
Standard Oil Company of California, 225 Bush St., San Francisco Plant Location—El Segundo Manager Refineries—R. W. Hanna General Superintendent—A. F. Brooks Superintendent—H. C. Hanna Assistant Superintendent—Geo. Davidson Plant Location—Richmond Superintendent—C. R. Finney Chief Engineer—H. H. Hall Chief Chemist—J. B. Rerry Plant Location—Bakersfield Superintendent—J. F. Faber Night Superintendent—W. R. Love	100,000 100,000 25,000	skim skim skim & asph.	77,600 60,900	Rich. Rich. & Comb.
Walter Steiner Refining Company, 2204 South St., Long Beach Plant Location—Long Beach President and Superintendent—Walter Steiner Chief Chemist—Walter Steiner	1,500	skim & lube		
Sterling Oil & Refining Company, Box 1114-A, Bell Plant Location—Bell	1,500	skim		
St. Helens Petroleum Company, Ltd., 1031 South Broadway, Los Angeles Plant Location—Pico General Manager—Charles Drader Superintendent—C. S. Webb Assistant Superintendent and Chemist—G. W. Sparks	4,500	skim & asph.		
The Texas Company of California, 929 South Broadway, Los Angeles Plant Location—Coalinga Plant Location—Los Angeles Manager Refineries—L. R. Holmes Superintendent—W. J. Ryan Chief Refinery Engineer—A. S. Patrick Assistant Refinery Engineer—John Gallagher Plant Location—Fillmore Superintendent—J. R. Scanlin	500[3] 30,000 4,000	skim skim skim	5,500 2,700	Holmes-Manley Cross
Triangle Oil & Refining Company, 563 Washington St., P. O. Box 325, Venice Plant Location—Venice General Manager—C. W. Allison Superintendent—L. R. Taylor	3,000	skim		

TABLE 1
Refining Companies, Location of Plants and Capacity, in California—Continued

COMPANY	Crude Capacity	Type	CRACKING Capacity	CRACKING Type
Union Oil Company of California, 914 Union Oil Bldg., Los Angeles Plant Location—Wilmington Director of Manufacture—R. E. Haylett (Los Angeles) Manager Refineries—L. G. Metcalf (Los Angeles) Manager Research—Dr. D. R. Merrill (Wilmington) Development Engineer—Earle W. Gard (Los Angeles) Superintendent—John Salmond (Wilmington) Cracking Superintendent—N. F. Myers (Wilmington)	51,000	comp.	34,000	Cross[5]
Plant Location—Oleum Superintendent—A. Roy Heise Superintendent Lube and Grease—G. H. Woods Supervisor Lube and Asphalt—C. F. Adams	17,000	comp.		
Plant Location—Avila Superintendent—R. W. Frazier	10,000	skim		
Plant Location—Bakersfield (Maltha) Superintendent—H. Ambrosier	5,000	skim & asph.		
Plant Location—Santa Paula Superintendent—C. W. Burtless	1,200	skim		
Western Oil & Refining Company, 416 West 8th St., Los Angeles Plant Location—Wilmington General Superintendent—R. R. Rakestraw Superintendent—O. C. Smith Assistant Superintendent—H. H. Spangler Chief Chemist—H. H. Spangler Chief Engineer—E. J. McKee	12,000	skim	4,200[3]	
White Star Refining Company, 2400 Artesia Blvd., Long Beach Plant Location—North Long Beach General Manager—D. R. Wilson	2,000[3]	skim		
C. A. Williamson, 574 North Gower St., Los Angeles Plant Location—Artesia Owner—Chas. A. Williamson	600	skim		
Wilshire Oil Company, 2455 East 27th St., Los Angeles Plant Location—Vernon (Los Angeles) Plant Location—Sante Fe Springs[6]	20,000 12,000	skim skim		Dubbs

[1] Operates as combined topping and residuum viscosity breaker. [2] Reformer. [3] Shut down. [4] 5,000 barrels is "Converter" process. [5] 22,000 residuum topping and viscosity reduction. [6] Building.

fuel stocks. And, apparently this is true despite the fact that the industry has been operating at less than 60 percent of rated or potential capacity in this area. Accompanying this discussion is presented, Table 1, a complete list of California refining companies. There are 63 operating plants with a total rated capacity of 728,635 barrels daily. Ten refineries were reported shut down at the beginning of this year, according to Bureau of Mines reports, and the total shut down capacity was reported at 91,200 barrels.

TABLE II
Cracking Processes in California Refineries[1]

	Capacity	Type
Associated Oil Company, Associated	21,000	Tube & Tank
General Petroleum Corporation, Torrance	6,000	Kellogg
Hancock Oil Company, Long Beach	1,200	Own
Mohawk Petroleum Company, Bakersfield	6,500	Own (Building)
Rice Ranch Oil Company, Santa Maria	600	Clark
Richfield Oil Company, Hynes and Watson	30,000	Cross and Black
Rio Grande Oil Company, Vinvale	3,500	Sinclair
Shell Oil Company, Dominguez, Martinez	75,000	Dubbs (34,950 shut down)
Standard Oil Company of California, Richmond and El Segundo	118,500	Richmond
The Texas Company (of California), Los Angeles and Fillmore	8,200	Cross. Holmes-Manley
Union Oil Company of California, Wilmington	34,000	Cross and Viscosity Breaker (3,000 shut down)
Western Oil & Refining Company, Wilmington	4,200	(4,200 shut down)
Wilshire Oil Company, Sante Fe Springs	8,000	Dubbs (Building)
Total capacity	316,700	
Total shut down	42,150	
Total building	14,500	

[1] Data in this tabulation based primarily on E. T. Knudsen's Bureau of Mines Report, "Petroleum Refineries, Cracking Plants and Natural Gasoline Plants on the Pacific Coast, January 1, 1935."

This gives a total of 73 refineries owned by 55 companies, with a potential charging capacity of 820,835 barrels per day.

CRACKING

Of the 55 companies refining petroleum only 12 engage in cracking. These 12 have 15 plants equipped with 66 operating cracking units. In addition, six plants have 17 cracking installations shut down. Two plants are building one unit each at this time. The American Petroleum Institute in its weekly statistics reports California with an operating cracking capacity of 274,000 barrels daily, or 12.4 percent of the total for the United States. This is approximately half of the rated cracking capacity of the East Coast district, the largest, which has a reported capacity of 534,000 barrels daily or 24.2 percent of the total for this country. In cracking capacity California ranks fourth in the 10 recognized refining districts.

Based on the Bureau of Mines' latest available survey of the West Coast area, the 15 operating plants with 66 units have a rated capacity of 258,850 barrels per day. The six refineries with 17 shut down cracking units represent a total of 42,150 barrels of inoperative cracking capacity. At the time of the report one 6500-barrel unit was under construction. Since that time a second 8000-barrel installation has been started at Santa Fe Springs. The total, however, as reported by the Bureau of Mines is 22 refineries, 84 cracking units, and total capacity of 307,500 barrels. The apparent confusion of capacity figures occurs because of the use of two sources of information. The discussion, however, is not intended

to be of extreme accuracy and is only for the purpose of presenting a picture of the industry and its facilities in this important refining district. Table 2 shows the cracking plant ownership, location, capacity, status and type of process employed.

PIPE STILLS

The Bureau of Mines in its recent survey of the industry on the West Coast included some interesting data on pipe stills. During the early part of the year, for example, it is reported that the 55 companies with 73 refineries, had a total of 166 pipe stills for distillation service. There were 140 operating tube stills with total capacity of 544,285 barrels per day. There were 26 idle stills with total capacity of 124,400 barrels.

Going further into the analysis, it is shown that 102 pipe stills operating on crude oil had a total capacity of 448,235 barrels per day. Twelve stills were operating on lubricating oils, and had a total capacity of 17,150 barrels. There were 11 pipe stills working on pressure distillate with a total capacity of 33,500 barrels, and on "other oils" there were 15 tube stills with total capacity of 45,000 barrels. From this analysis it is apparent that the average tube still in service now is around 4000 barrels capacity, whereas a few years ago a similar analysis gave an average figure of around 1500 barrels per still, thus confirming the earlier discussions to the effect that all types of refining facilities were included in the trend toward larger installations.

Analysis of tube still installation brings up another interesting point in regard to continued operation of equipment recognized by the industry as obsolete. In the instance of tube stills operating on crude in California it will be noted that there are 102 stills with total capacity of 448,235 barrels delegated to this service. These are actual operating units, but for present purposes the 91,200 barrels of shut down refining capacity is added to the 448,235 barrels, assuming that the 10 shut-down refineries are equipped only with pipe still distillation equipment. This gives a total of 539,435 barrels as capacity of pipe stills in crude oil service. The total potential capacity, based on Bureau of Mines reports, is 820,835 barrels. Therefore 281,400 barrels refining capacity remains, which apparently is processed through shell still batteries—which is about 34 percent of total capacity of the area. This is generally recognized as utilization of obsolete refining facilities.

Based on total refining capacity of 820,835 barrels, and total capacity of all tube stills of 672,685 barrels, there is a difference of 148,150 barrels capacity represented by shell still batteries, or about 18 percent of total capacity. Somewhere between the two figures of 18 and 34 percent is a true indication of the status of the shell still in this refining district—nor is this operation of equipment now accepted as obsolete at all peculiar to California, for it occurs in all refining districts. It is, however, rather unexpected in such large proportions, for the California area was the first to adopt and extensively use the tube still in general distillation work.

In the cracking phase of the industry all of the installations are pipe stills giving a total of 66 operating units, 17 shut down and two building. Thus the total number of tube stills in the West Coast refining district becomes 251, of which 43 are reported shut down, and 208 in operation.

SOLVENT REFINING

California refiners have been working with solvent refining methods since 1924 when Associated Oil Company installed the first Edeleanu process at Avon. In 1925 Shell Oil Company followed with a second and similar unit, but of larger capacity, at Martinez. No further work was done until 1934 when Standard Oil Company of California completed its aqueous phenol solvent plant at Richmond, and Union Oil Company of California began operating its Edeleanu plant at Oleum in conjunction with its propane deasphaltizing and dewaxing process perfected in its own engineering and development organization. The total reported charging capacity of solvent refining plants in this district is 8780, and the total output is 5320 barrels. With the exception of the Union Oil Company installation, overhead stocks are used exclusively for charging. Table 3 gives details of the solvent refining installation in the West Coast district.

The natural gasoline manufacturing industry in California consists of 40 companies (17 being allied with or identical with refining concerns) which own 125 plants, including 10 booster plants. According to latest available data compiled by the Bureau of Mines, there are 91 operating gasoline plants, with a total reported capacity of 3,178,780,000 cubic feet of gas daily, or 3,178,780 gallons of gasoline (75,683 barrels). In addition there are 24 shut-down natural gasoline plants in the area and the total gas capacity is reported at 223,900,000 cubic feet; or 273,600 gallons of gasoline (6514 barrels). Thus the industry consists of 115 gasoline plants capable of processing 2,361,355,000 cubic feet of gas daily and of producing 3,452,380 gallons of gasoline (82,198 barrels). Obviously, the industry in producing from 31,000 to 34,000 barrels of natural gasoline daily, is operating at less than half of its potential rated capacity.

The foregoing statistical discussion of the gasoline industry indicates the lack of necessity for expansion of plant facilities in this branch of the industry during the past year or two. In fact there has been but little construction in the area for the past three years. For the most part, those plants which have been erected represent assemblies of equipment available from inoperative installations. During 1934 the Kettleman North Dome Association enlarged its gas boosting facilities through the installation of a six

TABLE III
Solvent Refining Installations in California

	Type	Charge	Capacity	Output	Erected
Associated Oil Company, Avon.....	Edeleanu—SO_2	Overhead Stocks	1,000	700	1924
Shell Oil Company, Martinez.....	Edeleanu—SO_2	Overhead Stocks	3,000	2,000	1925
Standard Oil Company of California, Richmond...	Aqueous Phenol	Overhead Stocks	3,580	2,200	1934
Union Oil Company of California, Oleum.....	Edeleanu—SO_2	Overhead Stocks or Residuum	1,200 to 1,500	420 to 450	1934

compression unit booster plant. This plant is described in detail elsewhere in this issue. A gasoline plant was erected by Lomita Gasoline Company, Mountain View, Kern County, in 1934. This was described in THE REFINER by J. A. Campbell, issue of November, 1934, page 406. O. C. Fields Gasoline Corporation completed erection of a plant at Huntington Beach last year, which was described in these columns by J. C. Albright, in the issue of December, 1934, page 441. There has been much interest in stabilization, generally, and in production of liquefied petroleum gases, and much work has been done along these lines which has involved the installation of new and modern equipment of more or less special design.

Construction of refining equipment in the West Coast district during the past two years, other than the work done by major companies in moderization of their plants, consisted chiefly of the establishment of a number of small refineries in the Los Angeles Basin area. Many of these operated with the Pacific Coast Agency agreement, others operated "catch as catch can," and produced chiefly "motor fuel," which in California is said to mean anything sold that does not meet specifications, and usually marketed at lower prices. Most of the new plants employ tube stills with heat exchangers, flash columns and with more or less efficient fractionating columns.

Standard Oil Company of California has completed an extensive improvement program involving revamping of several cracking units and distillation systems, as well as construction of a new Kellogg cracking unit and aqueous phenol solvent refining system.

Union Oil Company of California, in the fall of 1934, completed its new lubricating oil plant at Oleum; de-asphaltizing, dewaxing, followed by liquid SO_2 refining, (REFINER, Vol. 13, No. 9, Sept., page 333, "Use of Propane in Lube Refining"). The plant is the first to process a so-called naphthenic base crude and manufacture from it a paraffin base lubricating oil.

Shell Oil Company in the fall of 1934 completed a new pressure distillate redistillation (Braun) unit, equal in capacity to the output of the Dubbs cracking units operated by the company at Dominguez. This company also recently completed a new Alco vapor recovery and stabilization unit at its Martinez refinery, and included facilities for manufacture of liquefied petroleum gases.

Rice Ranch Oil Company, Santa Maria, completed a Clark vapor phase cracking process early this year. This is the first installation of the Clark type which utilizes direct heat of combustion for cracking vaporized superheated gas oil vapors. This unit was described in REFINER by J. C. Albright, in the issue of February, 1935, page 43.

Hancock Oil Company at Long Beach, this year completed construction of a new cracking process, which was designed by company engineers. Chas. W. Fourle, has completed a modern skimming plant at Long Beach. At Huntington Beach, M. M. McCallem improved his plant through addition of a road oil unit. American Oil & Refining Company, late in 1934, completed a 2500-barrel skimming plant at Clearwater. Mohawk Oil Company, at Fruitvale, installed a 2000-barrel skimming unit in 1934 and now has under way a 6500-barrel combination skimming and cracking plant. Seal Beach Refining Company has completed construction of a 1500-barrel skimming plant, and Los Angeles Refining Company, on Bandini Boulevard, has erected a 2000-barrel tube still and fractionating equipment. At this time, Wilshire Oil Company is erecting a plant at Santa Fe Springs with capacity of 12,000 barrels of crude, and a Dubbs cracking unit of full flashing type, with capacity of 8000 barrels per day.

The fact that the California refining district is overbuilt, as is the case with all other refining districts, in no way means that the future will not see large expenditures made for refining equipment. The area is not yet supplied with sufficient modern cracking facilities, and as was shown earlier, a large portion of its existing cracking equipment is inoperative because of old age. The same is true of its distillation facilities, and in addition to the shell still batteries still operating which must ultimately be torn out to give way for more efficient equipment, many of its pipe stills are of a vintage now far out-stripped in efficiency by modern designs. The severity of corrosion is peculiar to the area and damage from this source is relatively higher than many areas where "sweeter" crudes prevail. Many of the plants are operating under conditions of bad water, bad soil conditions, severe corrosion conditions and thus, as a whole, the operating and maintenance problems and expenses are similar to those of refiners throughout the world. With only four companies engaged in operation of solvent refining processes for lubricating oil manufacture and with only 12 companies engaged in cracking, the further expansion of these two important departments is a foregone conclusion. Further improvements and important developments in fractionation are about ready for commercial exploitation, and the newer designs of combination skimming, cracking, reforming and stabilization processes are yet to secure extensive use in the West Coast refining district.

Changes

In Stabilizer System Secure Better Efficiency . . .

THE NORWALK Company, with a gasoline plant at Santa Fe Springs which has been in operation since the field was discovered several years ago, has been stabilizing the gross production of the plant by recompressing the tank and other recovered uncondensed vapors in the ordinary manner, then introducing the liquefied fractions of compression into the stabilizer column with the absorption gasoline. This method had been giving fairly good results, but the recycled vapors formed a load which the operators desired to dispose of in some manner.

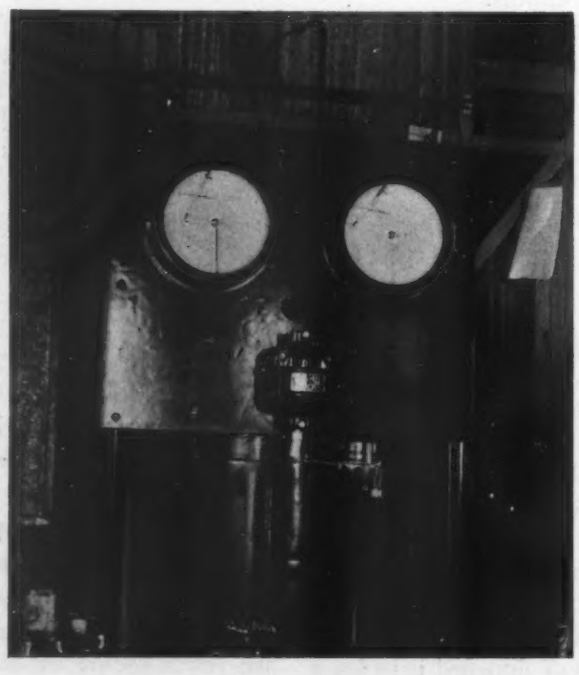
The installation included a recompressor which was operated at 225 pounds pressure, condensing the liquids contained in the recovered vapors in a series of atmospheric coolers. The uncondensed gases from the accumulator tank contained an appreciable amount of normal butane, which was desired to maintain the final volume of finished gasoline. These vapors, together with those coming from the stabilizer reflux accumulator drum, were used as boiler fuel.

These recovered vapors were carried through the usual gathering lines prior to compression, and passed through a scrubber where a small amount of liquids were trapped out. This was fed to the column along with the other liquefied products, but the overall operation was not one which was producing the best results.

When a change was made in the operation of the fractionator unit, the recompressor was continued in the previous arrangement, but the cooling and condensing sections were discontinued, and the hot vapors were introduced to the column direct. The sections which had been used in cooling and condensing the recompressor vapors were tied in series with the stabilizer overhead vapor condensers to provide additional cooling capacity for the added load on the column.

The liquefied product of absorption was fed above the sixteenth plate in the same manner as carried out in the previous method of operation, and the hot recompressed vapors fed to the twentieth plate. The liquid followed the same processing flow as previously operated, with the column carried at 215 pounds pressure. The reboiler temperature was maintained at 298° F., and the stabilizer top was held at 105° F. by pumping a sufficient amount of reflux to obtain the desired operating conditions.

The overall load placed on the stabilizer contained about 20 percent methane, due to the fact that a large amount of the residue gas was being used in the field as gas lift. It was thought that by operating the column with the total volume of recompressor vapors that the final product would be out of balance and would contain an undesirable proportion of propane, or that the overhead would not be stripped of the desirable iso-butane and n-butane. However, after the column had been placed in equilibrium, and had been operating with the new arrangement a sufficient time, an analysis disclosed that the bottom product was free of propane, and that the stabilizer overhead did not contain an appreciable amount of desirable hydrocarbons.



Continuous gravity recorder

The stabilizer unit is well equipped with control instruments, flow controllers, temperature regulators and a continuous gravity recorder. By the use of these instruments, the operator's duties are simplified as it is only necessary for him to follow a predetermined set of operating conditions to accomplish the desired fractionation.

Ifs

If you are dissatisfied with your yield of gasoline—

If your customers are dissatisfied with its quality—

If your stockholders are dissatisfied with their returns—

You need Dubbscracking

Dubbscracking gives you the biggest yield of the best gasoline from any charging stock—and at lowest cost—royalty and all

And secondary products that are worth more than the oil you started with

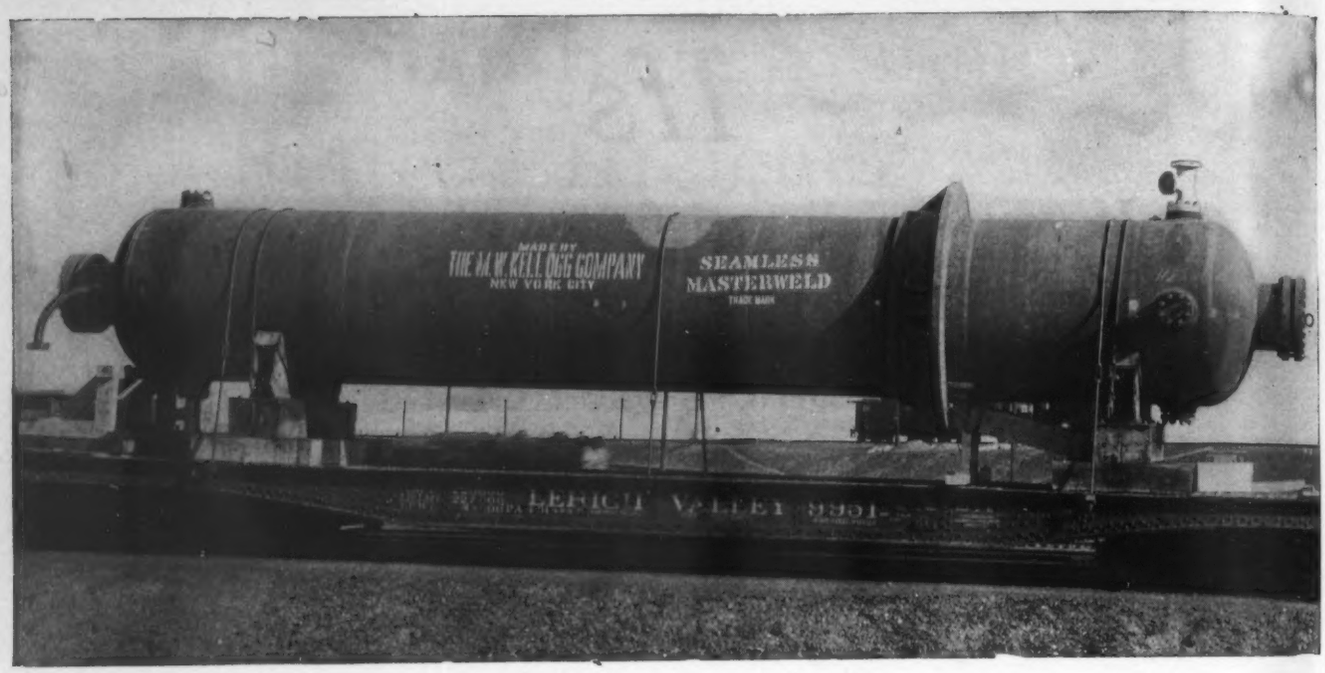
There are no Ifs in Dubbscracking

Universal Oil Products Co
Chicago, Illinois

Dubbs Cracking Process
Owner and Licensor

KELLOGG MASTERWELD DUCTILE TOUGH

Soaking drum 72" x 4½" thick x 48' overall, seamless section construction.



4½" thick Soaking Drum fabricated by KELLOGG

ACCUMULATORS
BUBBLE TOWERS
DEPHLEGMATORS
HEAT EXCHANGERS
HEADERS—Return Bends
REFLUX TOWERS
PIPING—Plain and Corrugated

One of the prominent oil refineries was in the market for a soaking drum. After investigation they selected, as best suited for their purpose a Kellogg "Masterweld" vessel. Incidentally this soaking drum was the first heavy walled, welded pressure vessel ever purchased by this company.

This vessel was fabricated from Kellogg rolled steel seamless cylinders produced in our own plant and joined together with girth welds made by the Kellogg "Masterweld" process.

The successful record of scores of Kellogg pressure vessels operating in various industries was a contributing factor to the decision of this refinery.

THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK

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The Look Box

(*Continued from page 330*)

Cracking Patent Decision Confirmed

THE United States Circuit Court of Appeals, Third Circuit, in Philadelphia, on June 26 handed down a unanimous opinion in favor of Universal Oil Products Company, owner of the Dubbs cracking process, in its suits against Root Refining Company for infringement of two Universal patents and for damages resulting from that infringement. The decision confirms the finding of Judge P. Nields in the Federal District Court at Wilmington, Delaware, on April 27, 1934. The case was appealed by Root Refining Company.

The two patents in the suit are No. 1,392,629, issued to Carbon P. Dubbs, October 4, 1921, generally referred to as the clean circulation patent, and No. 1,537,593, issued to Gustav Egloff, May 25, 1925, known as the multiple coil or selective cracking patent. Both are owned by Universal Oil Products Company. The validation of these two patents is of importance to refiners the world over.

Contact Clay Patent Litigation Ended

According to an announcement by G. Howard Hutchins, president of the Filtrol Company of California, settlement of the patent infringement suit brought against that company by the Contact Filtration Company of San Francisco has been effected. The suit has been pending in federal court for several years.

The Filtrol Company has consented to a stipulation under which final decree has been entered in the suit. This decree provides that Contract Filtration Company's patents are good and valid in law; that said patents have been infringed by The Filtrol Company and that The Filtrol Company is enjoined from further infringement of Contact Filtration Company's patents.

An agreement with Contact Filtration Company provides that The Filtrol Company becomes the exclusive licensee for the manufacture of activated clay in the United States and acquires the right of licensing the use of activated, acid sprayed and raw clay to the petroleum industry as well as extending license to others to sell the latter for use under Contact Filtration Company's patents. The Filtrol Company, in securing this exclusive agency license under the patents of the Contact Filtration Company, has acquired from Max B. Miller & Company, Inc., the necessary agency rights which that concern has enjoyed for many years. Hereafter, with the sale of acid activated clay under the brand name of "Super Filtrol," The Filtrol Company of California will extend to the purchasers thereof, without additional cost, the right to employ such clay under the patents of the Contact Filtration Company. This license right will include all patents owned by Contact Filtration Company which relate to the decolorization, clarification and neutralization of petroleum oils and products thereof.

The agreement provides that Max B. Miller & Company, Inc., may continue in the business of selling acid sprayed and raw clay as heretofore, extending to the purchaser thereof a license to use such clay under the oil processing patents of Contact Filtration Company.

Supplementing the foregoing, Lester L. Robinson, chairman of the Board of Directors of The Filtrol Company, announced that the Filtrol Company of California and Attapulgus Clay Company have completed negotiations which will result in the activated clay business of the United States being conducted by these companies on a joint basis. Robinson stated that plans for erecting additional plant capacity to care for the growing demand for activated clay are practically completed. and that methods are being evolved through which consumers may enjoy the best of technical service and derive the greatest possible economies in all matters relating to contact filtration. Further details of this latter development will be announced from time to time.

International Exposition At Tulsa May 16-23, 1936

THE Ninth International Petroleum Exposition and Congress will be held May 16 to May 23, 1936, at Tulsa, according to announcement made at the conclusion of a special meeting of the board of directors June 14. W. B. May, general manager of the exposition, stated that several applications already had been made for space, although no formal announcement had been made as to the exact date. Plans for repairs and improvements at the exposition grounds are being given consideration.

Conventions

A. C. S. The American Chemical Society meets at San Francisco, California, August 19 to 24.

N. P. A. The National Petroleum Association, September 18-20, will hold its annual meeting at Atlantic City.

A. G. A. The American Gas Association, Manufacturers Division, will meet at Atlantic City, October 14 to 18.

N. S. C. National Safety Council holds the twenty-fourth annual Safety Congress, in Louisville, Kentucky, October 14-18.

I. P. A. Independent Petroleum Association will hold its 6th annual meeting at Dallas, Texas, November 4 and 5.

A. P. I. The American Petroleum Institute will hold its 16th annual meeting at the Biltmore Hotel, Los Angeles, November 11-14.

C. N. G. A. The California Natural Gasoline Association holds its meeting the first Thursday of every month in the Richfield Building, Los Angeles, California.

Louisiana-Arkansas Refiners Association, Technical Division, holds monthly technical group meetings the second Friday of each month at announced meeting place.

Michigan University Offers Refining Courses

THE recently published announcement of courses in chemical and metallurgical engineering at the University of Michigan includes a number of courses devoted to the study of petroleum refinery engineering. Courses are available in fuels and furnaces, chemical technology of the organic industries, unit operations, testing petroleum products, motor fuels and lubricants and petroleum and internal combustion engine fuels. Advanced study also is available under Dr. G. G. Brown on natural gasoline and compressed gases and petroleum refinery engineering. In undergraduate work engineering students have available broad fundamental training in chemical engineering. Graduate work provides opportunity for specialized training in specific fields.

Stainless Steels Second Edition

THE second edition of The Book of Stainless Steels, published by the American Society for Metals, Cleveland, Ohio, now is available. Much new material has been added and all of the old has undergone revision at the hands of the 82 authors assisting in its production. The book has 800 pages, an increase of 168 over the first edition published in 1933, and 27 chapters are new or have been revised.

A chapter on arc welding of high cromium irons by J. C. Hodge; a number of chapters on various types of castings by A. C. Jones; a chapter on 29 percent chromium, 9 percent nickel by R. J. Wilcox; a chapter on Requirements of Petroleum Refineries by E. S. Dixon, The Texas Company, and the index of trade named alloys produced in the United States by C. E. Plummer, are notable additions to be found in the second edition.

The book is divided into six parts: General Considerations; Production and Fabrication; Properties of the Typical Alloys; Specialized Tests; Requirements of the Consuming Industries, and indexes. The book may be secured from the society for $5.00.

Corrosion-Causes and Prevention

THE second edition of "Corrosion, Causes and Prevention," by Frank N. Speller, recently has been published. It is a completely revised edition bringing to date a comprehensive review of the literature on the subject of corrosion. The first edition was presented in 1926 and was recognized as the outstanding work on this subject. Since publication of the first edition approximately 3,000 articles on corrosion of metals have been published, making available a vast amount of information, and many more and better experimental data are available with respect to both the influence of various factors and means of combatting and preventing corrosion. Dr. Speller has carefully reviewed and edited each chapter and to keep the book within reasonable bounds the older sections have been condensed or omitted where better data are at hand. The new book contains 694 pages, includes a complete bibliography and in addition to a classified index car-

ries an authors index. Copies can be secured from The Gulf Publishing Company, Book Department, Box 2811, Houston, Texas, price $7.00.

New Definitions Non-viscous Neutral

IN order to insure enforcement of the license regulations as issued by Pennsylvania Grade Crude Oil Association, the directors of the association have amended the section of the regulation prohibiting blending of non-viscous neutrals in Pennsylvania grade motor oils. The regulations now define non-viscous neutral as follows:

"The term non-viscous neutral is definite as a neutral oil of a viscosity less than 142 Saybolt Universal seconds at 100°F."

Wording of the former section based the definition on viscosity at 150 Saybolt seconds at 70°F. Since the old type viscometer, which was used to make this determination, is no longer in general use, the Technical Advisory Committee recommended that the change be made.

15th Exposition of Chemical Industries

THE Fifteenth Exposition of Chemical Industries which occurs this year will be a truly great industrial event to judge by the factors and forces which are increasing in momentum at this time when the show is still six months away. The Exposition will be held during the week of December 2-7, 1935, at Grand Central Palace, New York City. In addition to its display of raw materials and finished products the event this year promises to be a great exposition of equipment in terms of heavy plant machinery and the innumerable asseccory machine units which serve the great industrial plants and represent the handling of mass production operations after they have been worked out in the laboratory and semi-work's production scale. Quite naturally this trend will be responsive to the fact that the American market, after years of depression, has a stored up demand for capital goods and for plant equipment generally, to replace units which the mere factor of obsolescence should have replaced sooner. Statisticians point out that there is more than $100,000,000 set aside for new plant projects in the process industries. As a background for building and machine maintenance the chemical processes to be handled must certainly be advanced by the unprecedented backlog of research facts which are available. The factors of accumulating reserves, improved business confidence, obsolescence, and the trend toward new product development, must inevitably combine to make the 15th Exposiiton of Chemical Industries a natural market place.

The Chemical Exposition in December will carry on from the high point which the 14th Exposition of Chemical Industries established in 1933. Dominant again will be the new school of thought with respect to the technique of exhibiting at expositions. While the exposition in 1933 was outstanding in its recognition of the value of well planned exhibits, this trend will be greatly augmented in 1935 because not only is the improvement well recognized, but there is now more confidence in terms of the means available for carrying it forward.

The American industrial spirit has been refined by the depression. It is open minded, but highly analytical of what is claimed and how it is presented. Visitors to the Chemical Exposition will notice that some exhibitors call attention particularly to key items of equipment or material products. From these the eye of the observer will pass to the background of the exhibit, seeing clearly the relationship of other products of the exhibitor, perhaps earlier inventions or products auxiliary in function. Some things are emphasized; others provide the background. Assisting in this method of selective emphasis will be the use of animation, color, and light. It is all part of the new psychology of exhibit presentation which seeks to clarify. The tendency to show not only the material or the machine, but to make the visitor understand just how it is used, is part of the exhilarating trend from static to dynamic exhibit style.

An additional factor of appropriate timing is seen in the fact that the 15th Exposition of Chemical Industries, by virtue of the week during which it is presented, will be available to the great influx of members of the mechanical engineering fields who will be in New York attending the national mid-winter meeting of the American Society of Mechanical Engineers. The matter of design, purchase, and operation of industrial plant equipment—the functions of chemical engineering and mechanical engineering—are increasingly related.

The recent Tercentennary of the American Chemical Industries brought the subject of their work and realization of their importance to national attention. The 15th Exposition of Chemical Industries will tell a story in terms of actual materials and machines which make up this great group of industries.

Revised Commercial Standard for Fuel Oils

THE National Bureau of Standards, Department of Commerce, has announced that Commercial Standard CS12-35 on fuel oils (third edition), a revision of the second edition, CS12-33, covering the more important characteristics essential to satisfactory burning oils is now available in printed form.

Six distinct grades are described in the publication with limits as to flash point, pour point, water and sediment, carbon residue, ash, distillation range, and viscosity. Experience has indicated the advantage of limiting the above characteristics in order to provide a better classification for competition and an improved system of designating quality, which before the appearance of definite grade standards was limited only by gravity—an index now looked upon as a very poor indicator of suitability to the burner, according to the Standard Bureau.

The commercial standard was originally published in 1929 as Commercial Standard for Domestic and Industrial Fuel Oils, CS-12-29. Oils used for heat treatment furnaces, for glass and ceramic furnaces, and other special uses, sometimes necessitate a low sulphur requirement.

To meet these special needs the standard was revised to carry a table showing permissible maximum sulphur content for each grade as a guide for the purchasers. This revision was published in 1933 under the abbreviated title of "Fuel Oils (second edition), Commercial Standard CS-12-33."

In order to prevent overlapping of grades and misrepresentation in the direction of supplying a lighter oil than indicated by the grade number, both upper and lower limits for some characteristics have been incorporated in the present revision. Maxima for carbon residue or ash are included in grades 1 to 5. As a result of improvement in oil burners the viscosity of No. 3 oil has been increased, as representing the heaviest grade suitable for use in certain domestic types of burners. Nos. 4, 5 and 6 are suitable generally for industrial types of burners.

Although the latest revision closes the major loopholes for misunderstanding and unfair competition as indicated by composite experience, it is generally conceded that additional data, and possibly some new criteria are needed as a basis for future revisions to insure a more complete adaptation of burners and fuel oils to each other, it was stated.

Having been endorsed by a large number of important oil refiners, burner manufacturers, distributors, and organized consumers, estimated to represent a satisfactory majority, the revised standard became effective January 15, 1935.

The pamphlet includes, in addition to the standard specification, a list of acceptors and a brief history of the project. Copies are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

Characteristics of Texas Crude Oils

TO make generally available the many analyses of Texas crude oils that have been examined by the Bureau of Mines, a report in condensed tabular form has been issued in order that reference may be made to the characteristics and other data pertaining to these oils under one cover.

Analyses of 313 crude oil samples are included in the tabulation which has been divided into six parts, generally descriptive of the geologic subdivisions of the state, although some of the oils included in a group may be of another age. Group 1 includes oils of Permian age, produced in the Texas Panhandle; group 2, West Texas Permian oils; group 3, oils from Pennsylvanian and older formations produced in the North Texas area; group 4, oils of Cretaceous age, produced in the East Texas basin; group 4a, Cretaceous oils, produced in the Central Texas area; and group 5, oils of Eocene or younger age, produced from the Texas Coastal area.

Following the procedure in a companion paper, Report of Investigations 3253, "Analyses of Crude Oils from some Fields of Southern Louisiana," the classification of the base of the crude oil heretofore reported under three major divisions, has been extended by adding four intervening groups making a total of seven. The new classification is paraffin, paraffin-intermediate, intermediate-paraf-

fin, intermediate, intermediate-naphthene, naphthene-intermediate, and naphthene.

Copies of R. I. 3252, "Tabulated Analyses of Texas Crude Oils," by Gustav Wade, may be obtained without cost upon request to the Information Division, Bureau of Mines, Washington, D. C.

Cracking Development Conference; 7th Meeting

THE seventh regular meeting of the Cracking Development Conference occupied a three day session, ending May 2, and centered in New York with the Hotel New Yorker as headquarters. The program included an inspection trip to the Bayway refinery, and on the evening of May 2 Standard Oil Company of New Jersey group were hosts at a dinner to those attending the conference. Previous meetings of the Cracking Development Conference, which is attended by petroleum technologists and executive representatives from the participating company groups, have been held at Whiting, Indiana, New York, and Port Arthur.

Participating at the recent conference were the Standard Oil Company (Indiana) group, The Texas Company group, The Standard Oil Company of New Jersey group, Gasoline Products Company, Inc., and The M. W. Kellogg Company group. William F. Moore, vice president and general manager of Gasoline Products Company, who is general chairman of the Cracking Development Conference, presided at the sessions in New York.

The purpose of the Cracking Development Conference is to review technical developments and to consider methods of processing and equipment applicable to the cracking field. As cracking technology becomes more complex and its literature voluminous the conference is found increasingly valuable as a coordinator of results. It acts as a committee on standards used in the design of equipment and serves as a clearing house for improvements in processing methods. Improvements favorably considered are incorporated by The M. W. Kellogg Company as designers, engineers, and licensing agents in new plant designs and in the remodeling of present cracking equipment of Gasoline Products Company licensees. Gasoline Products Company is concerned with the furtherance and coordination of research and development from the standpoint of process equipment, especially with respect to cracking processes for which it is licensor, such as Cross, deFlorez, Holmes-Manley, Tube and Tank, and combination units. Development of new features in the design and operation of new equipment for pyrolytic cracking is a function of several associated refineries, the results of which are available to licensees. The coordination of research and development by company groups participating in the conference is in line with the increasing general importance which cracking assumes in view of the demand for improved gasoline adaptable as motor fuel for engines designed for higher compression ratios.

Principal topics discussed during the three day session included the following: Holmes-Manley low liquid level and super-clean circulation operations; Whiting continuous pressure stills—general operating data on gas oil cracking and naphtha reforming; Holmes-Manley cracking—comparative yields from virgin and stripping plant cycle gas oils by super-clean circulation and low liquid level; Whiting continuous pressure stills—recent development work; Holmes-Manley super-clean circulation—charge reflux exchanger in bottom of No. 2 fractionating tower; Double vs. single soaking drum operations on gas oil; Experimental two-stage gas oil cracking at Baton Rouge; Continuous coking operations of The Texas Company; Combination cracking—Whiting 369 unit operations; Combination cracking—Casper combination unit operations; Combination cracking — Texas City combination unit operations; Production of casinghead equivalent at the Aruba refinery; Comparative yields and capacities producing fuel oil directly vs. blending heavy fuel with light cycle stock when cracking gas oil; Segregation of charge stocks to conform to equipment and conditions employed and to permit multiple-stage cracking; The improvement of fractionation in evaporators; Summary of the work of the committee on research; Plant scale viscosity breaking experiments at Baltimore, Baytown, Baton Rouge and Halifax; Viscosity breaking by injection of reduced crude in heater at maximum temperature of clean oil; A comparison of the economics of viscosity breaking residue with vacuum distillation followed by cracking; Naphtha reforming operations—effect of distillate endpoint and heater coil outlet temperature; A comparison of the economics of naphtha reforming with the use of tetra-ethyl lead.

Equipment, design and operation embraced many subjects for discussion, among which were the following: Pressure drops in cracking furnaces; Design of heater tubing; High temperature insulation of the permanent and removal types; The economics of insulating oil refinery equipment; Design pressures and safety valve settings for pressure vessels; Centrifugal pump—operating results at Bayway and Baltimore; Methods of reducing scoring on plungers of hot oil pumps; Instruments and controllers; Bayway cracking equipment and operations; Tests and heat balances on Texas City combination cracking unit; Summary of the work of the committee on heat balances; Transfer line heat exchangers; Welding technique; Methods of cooling coke drums on continuous coking units and perceptible effects on the steel of the vessels; Correlation of corrosion data on Baytown heater tubes; Correlation of corrosion data on cracking units and pipe stills; Corrosion data; Linings for pressure vessels; Corrosion determination and control.

Increased Demand for Liquefied Petroleum Gases

THE marketed production of liquefied petroleum gases totaled 48,173,000 gallons in 1934, a gain of 23.7 percent over the 38,931,000 gallons reported for 1933, according to the United States Bureau of Mines, Department of the Interior. This represents an increase of 9,242,000 gallons for 1934 over 1933, the largest gain in demand for any year excepting 1931. The following table illustrates the rapid expansion in the marketed production of liquefied petroleum gases during the period 1928-1934.

TABLE I—Marketed production of liquefied petroleum gases, 1928-1934

YEAR	Total Marketed Production in Thousands of Gallons	Increase Over Previous Year	
		Thousands of Gallons	Percent
1928.....	4,523	3,432	314.6
1929.....	9,931	5,408	119.6
1930.....	18,017	8,086	81.4
1931.....	28,770	10,753	59.7
1932.....	34,115	5,345	18.6
1933.....	38,931	4,816	14.1
1934.....	48,173	9,242	23.7

Propane, butane, pentane and propane-butane mixtures are the liquefied petroleum gases covered in this annual survey. The gain in demand for butane was again outstanding, the total for 1934 increasing to 25,553,000 gallons or 34.1 percent over 1933. The market for propane in 1934 was 18,681,000 gallons compared with 15,835,000 gallons in 1933. Deliveries of pentane and propane-butane mixtures were slightly less in 1934, totaling 3,939,000 gallons compared with 4,040,000 gallons in 1933. Sales of pentane considered separately were of minor importance, totaling only 832,000 gallons in 1934 and 814,000 gallons in 1933.

A study of the various demands for the several gases covered in this survey shows that the industrial requirements for butane increased from 12,180,000 gallons in 1933 to 19,443,000 gallons in 1934, while the quantity used for gas-manufacturing purposes declined from 6,170,000 gallons in 1933 to 5,064,000 gallons in 1934. The domestic demand for butane in 1934 was 1,046,000 gallons compared with 706,000 gallons in 1933. About 900,000 gallons more of propane were consumed for domestic purposes in 1934 than in 1933; however, a more significant gain in the consumption of this gas was made in the industrial field, the demand increasing from 1,300,000 gallons in 1933 to 3,119,000 gallons in 1934. Deliveries of propane for gas manufacturing in 1934 were 326,000 gallons compared with 200,000 gallons in 1933. Pentane and propane-butane mixtures used by gas manufacturing plants in 1934 declined to 900,000 gallons from 1,948,000 gallons in 1933. Sales for domestic purposes were also less in 1934, but pentane and propane-butane mixtures delivered for industrial purposes increased from 507,000 gallons in 1933 to 1,640,000 in 1934.

Propane is used largely for domestic purposes in households beyond the reach of gas-company mains, but new uses are constantly being found for this gas by the manufacturing industries, particularly those requiring a close control of heat. Petroleum refiners use propane as a solvent in the manufac-

ture of lubricating oils and as a refrigerant in dewaxing. Butane which is used principally for industrial purposes, also serves as an enriching agent in gas manufacture. Recent experiments on the Pacific Coast indicate that propane-butane mixtures make a very satisfactory motor fuel for internal combustion engines. So far this use for automotive vehicles has been largely confined to heavy-duty trucks and busses, which run between fixed terminals, where supply points for these gases have been established.

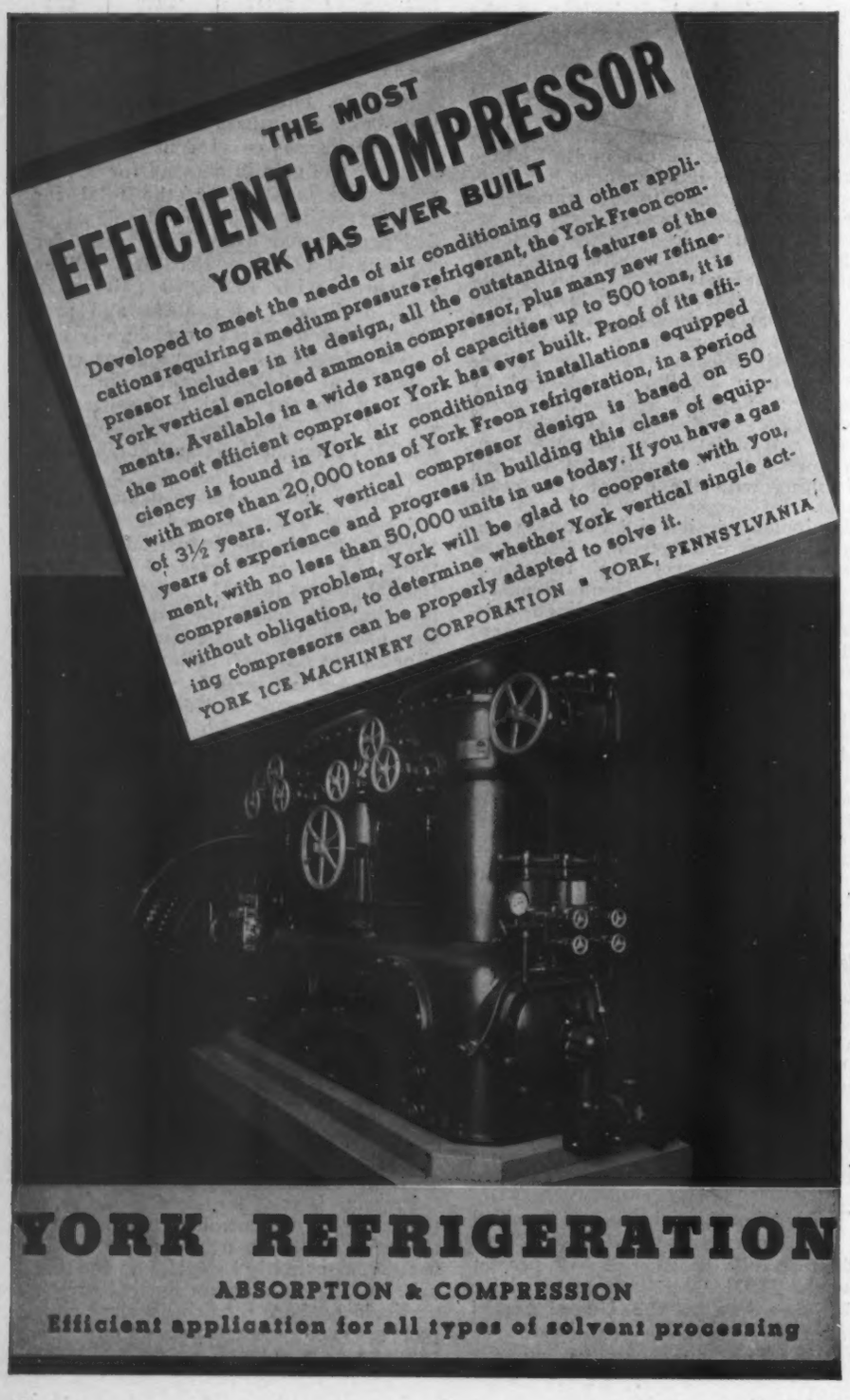
The American Gas Association has cooperated with the Bureau of Mines in this review of liquefied petroleum gases in 1934 by furnishing the following information regarding their distribution:

"Liquefied petroleum gas continued to gain favor among the small communities throughout the country during 1934. Three new companies began operations bringing the total up to 72. These 72 companies supplied gas to approximately 30,000 customers in 171 communities in 28 states. Butane-air-gas with a heating value ranging from 520 to 600 B.t.u. per cubic foot was supplied to 110 communities in 26 states by 59 companies. Undiluted butane and propane gas with a heating value of 2800 to 3000 B.t.u. per cubic foot was supplied to 14 communities in California and Nevada by six companies. Seven companies in Maryland, Minnesota, New Jersey, North Dakota, Virginia and Wisconsin supplied 47 communities with undiluted propane gas with a heating value of 2550 B.t.u. per cubic foot.

"Although no new communities in Canada were added during the year, persons living within a 30-mile radius of Calais, Maine, were given an opportunity to receive gas service by the formation of the Citizens Philgas Company. Milltown and St. Stephen, New Brunswick, continued to be supplied from Calais, Maine, while the plant at Three Rivers, Quebec, continued to supply the town."

Most of the material gain in demand for liquefied petroleum gases, has been in the industrial field, where bulk shipments are the usual method of handling, consequently the quantity moving into consumption by tank car, tank truck and pipe lines increased to 32,794,000 gallons or 68.1 percent of all shipments in 1934, compared with 24,515,000 gallons or 63.0 percent of the total deliveries in 1933. Cylinder and drum shipments in 1934 were 15,379,000 gallons, which, although higher than the 1933 total, represented only 31.9 percent of all shipments, compared with 37.0 percent in 1933.

This study of the marketed production of liquefied petroleum gases during 1934 has been made possible through the cooperation of 22 companies, six of which operate in the Pacific Coast area. Deliveries on the Pacific Coast were 11,471,000 gallons, a gain of 70.8 percent over 1933. This sharp rise in the demand in this area is largely the result of the increased use of these gases as fuel for internal combustion engines. Deliveries east of the Rockies were 36,702,000 gallons in 1934, a gain of 13.9 percent over 1933.


THE MOST
EFFICIENT COMPRESSOR
YORK HAS EVER BUILT
Developed to meet the needs of air conditioning and other applications requiring a medium pressure refrigerant, the York Freon compressor includes in its design, all the outstanding features of the York vertical enclosed ammonia compressor, plus many new refinements. Available in a wide range of capacities up to 500 tons, it is the most efficient compressor York has ever built. Proof of its efficiency is found in York air conditioning installations equipped with more than 20,000 tons of York Freon refrigeration, in a period of 3½ years. York vertical compressor design is based on 50 years of experience and progress in building this class of equipment, with no less than 50,000 units in use today. If you have a gas compression problem, York will be glad to cooperate with you, without obligation, to determine whether York vertical single acting compressors can be properly adapted to solve it.
YORK ICE MACHINERY CORPORATION • YORK, PENNSYLVANIA
YORK REFRIGERATION
ABSORPTION & COMPRESSION
Efficient application for all types of solvent processing

Butane-Propane Gases Handbook, Second Edition

THE second edition of the Butane-Propane Gases Handbook is now available. The handbook is the only publication relating to the field of liquefied petroleum gases, and the second edition records in detail the developments of the past two years in a comprehensive manner. The book fills a real need and is a handy and authoritative reference work for those engaged in any phase of the manufacture, handling and distribution of the lighter hydrocarbons.

Following are the chapter heads: Summary of developments during the past two years; Use in internal combustion engines; Design and installation of storage; Supply from petroleum refineries; Engineering data on the lower olefins; Domestic appliance testing and utilization; Economic comparisons with coal oil, electricity, producer gas and manufactured gas; Town Plants, Special uses, Volume Correction factors. In regard to the supplements and revisions a number of the chapters of the first edition have been retained and additions and modifications made by the authors to bring them in line with present knowledge. Late information will be found in Transportation, Use with other gases; Analysis and testing, Properties of Mixtures; and Bottled gas distribution.

Copies can be secured through the Gulf Publishing Company, Box 2811, Houston, Texas. Price $5.00.

Refineries Spent Billion For Supplies and Power

THE average large petroleum refinery in the United States spent approximately $278,379,000 for materials, containers, fuel, and electric power, and $233,468 for wages, and produced goods valued at $357,696 in 1933, data compiled by the American Petroleum Institute reveals.

It is estimated that the 367 largest refineries purchased from other industries supplies and power at a total cost of $1,023,131,731. Wage earners, excluding salaried officers and employes, received a total of $85,683,204. Employment was furnished to 65,973 full and part-time workers. Total value of products is placed at $1,312,745,262.

The figures, based largely upon the Department of Commerce Census of Manufacturers, present an incomplete picture of the American refining industry, it was explained, since operations of only the larger refineries are covered. All totals and averages would be increased were all refineries operating in the 35 refining states included. Totals and averages for the number of employes and wages earned were influenced by the employment of part-time workers.

Data for some of the larger refining states follow:

STATE	Number of Refineries	Number of Wage Earners	Wages Paid	Spent for Materials, etc.	Value of Products
California	48	6,858	$9,636,156	$168,571,813	$212,939,324
Oklahoma	43	4,664	5,969,965	55,774,481	74,255,041
Texas	90	15,795	18,700,444	226,634,908	71,446,111
Pennsylvania	37	8,495	11,557,572	123,179,057	42,337,273
Kansas	21	3,181	3,827,260	34,658,384	48,801,486
Montana	18	215	278,066	3,233,782	4,441,195
Wyoming	15	900	1,395,570	16,626,521	17,179,165

Carbon Black Operations in 1934

THE carbon-black industry, which had given indications of recovering from the depression in 1933, made marked progress in 1934. Although the indicated plant demand in 1934 was considerably under the total of 1933, prices were approximately 30 percent higher and it is probable that profits were larger despite the increased costs under the code signed February 8, 1934. Production of carbon black in 1934 was 328,828,000 pounds, an increase of 20 percent over the output in 1933. Stocks at the plants which had shown a material decline in 1933, due to speculative buying before the anticipated rise in prices, increased approximately 16,000,000 pounds in 1934. The total on hand December 31, 1934, was 171,799,000 pounds, or about six months' supply.

In 1934 the center of the carbon black industry remained practically stationary as production in Louisiana showed approximately the same percentage increase as that in the Texas Panhandle. The output of carbon black in the Texas Panhandle was 72 percent of the total output of the United States in 1934; the production in 1934 totaled 237,403,000 pounds, an increase of 22 percent over the production in 1933.

The average yield of carbon black declined from 1.44 pounds in 1933 to 1.43 pounds in 1934, probably a reflection of the gain in the relative importance of channel blacks. The carbon black industry utilized 229,933,000,000 cubic feet of natural gas in 1934, compared with 190,081,000,000 cubic feet in 1933.

Sales of carbon black declined from 374,468,000 pounds in 1933, to 312,612,000 pounds in 1934, probably due to speculative buying on the part of customers in 1933. Of the total sales, 120,620,000 pounds (39 percent) were exported and 191,992,000 pounds (61 percent) were sold to domestic customers. Of the domestic sales, 165,446,000 pounds (86 percent) were consigned to rubber companies, 16,146,000 pounds (8 percent) to ink companies, 5,365,000 pounds (3 percent) to paint companies, and 5,035,000 pounds (3 percent) to companies producing miscellaneous products. The carbon black industry was stimulated by increased activity at rubber factories here and abroad. The consumption of rubber, both crude and reclaimed, in the United States in 1934 totaled 554,000 long tons, a gain of 14 percent over 1933. Data on the consumption of reclaimed rubber in foreign countries are not available, but the "absorption" of crude rubber outside the United States in 1934 totaled 488,800 long tons, or an increase of 20 percent over 1933.

Exports of carbon black decreased 21 percent in 1934. The United Kingdom, France, Germany, in the order named, continued to be the leading customers. The value of carbon black exports for 1934 was $5,541,143, or practically the same as in 1933, indicating that increased prices compensated the loss in volume.

Effective January 1, 1934, a new series of carbon black prices were posted; in general, these represented increases over the levels of 1933. The average value of carbon black at the plants advanced from 2.78 cents in 1933 to 3.54 cents in 1934, the total value increased from $7,602,000 in 1933 to $11,654,000 in 1934.

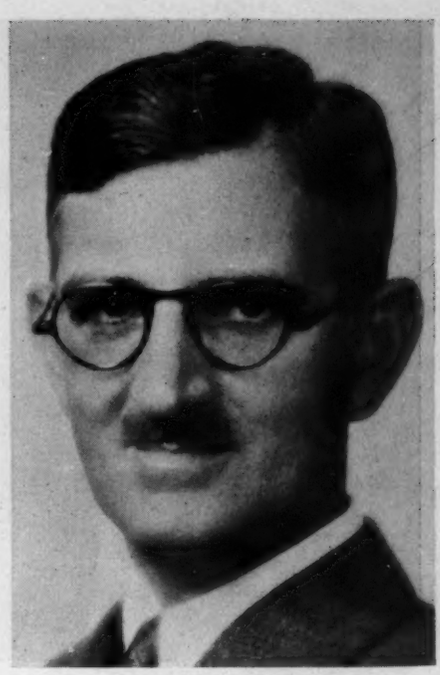
CNGA Elects New Officers 1935-1936

THE California Natural Gasoline Association elected Tom Taggart of Standard Gasoline Company, president, and Harold R. Linhoff, of Richfield Oil Company, vice president, for the ensuing year. The new officers were initiated into office at the annual June Frolic, June 8, at the Sunset Canyon Country Club in Burbank.

Taggart succeeds H. L. Eggleston of Gilmore Oil Company, who has given the association one of its most successful years.

Linhoff is manager of the Signal Hill Gasoline Company, a subsidiary of Richfield Oil Company of California.

Directors were also elected to serve for the ensuing two years to take the place of those whose terms are expiring as follows:



T. L. TAGGART

H. L. Eggleston, Gilmore Oil Company; L. L. Aubert, Norwalk Company; A. H. Bradford; F. E. Davie, Shell Oil Company; R. W. Heath, Signal Oil Company; E. J. Lange, Associated Oil Company; H. E. Moulton; R. S. Tulin, Shell Oil Company; T. K. M. Smith, Industrial Fuel Supply Company; John Rogers, Ingersoll-Rand Company; R. C. Wheeler, General Petroleum Corporation; A. H. Bell, Continental Oil Company; J. C. Burks, Fields Gasoline Corporation; R. D. Gibbs, Union Oil Company; W. Keck, Jr., Superior Oil Company; A. E. Schiltz, Del Rey Gas & Oil Company; W. D. Smith, Wilshire Oil Company; W. M. Young, The Texas Company; P. E. Fluor, Fluor Construction Company.

Wallace McIlhany enters his sixth year as secretary and treasurer of the association.

H. R. LINHOFF

A. M. EDMISTON

C. R. VEGH GARZON, chief engineer, Petroleum Department, Administracion N. de Combustibles Alcohol Y Portlant, (ANCAP) Montevideo, Uruguay, South America, standing at the left in the photo, accompanied by G. Wallace Miller, Universial Oil Products Company, and THE REFINER'S Editor, recently spent the morning visiting and inspecting Shell Petroleum Corporation's Houston refinery. Vegh Garzon is spending several months in the United States, Canada and England on a trip of inspection of refineries and cracking facilities. His company is now engaged in the establishment of a modern skimming and cracking plant at Montevideo, Uruguay, including Foster Wheeler distillation system and Dubbs cracking unit, stabilization and recovery system and other modern accessory facilities. It is planned to have the plant completed and in operation early in 1936.

A. M. EDMISTON has been elected president of Blackgold Refining Company, Oklahoma City, following resignation of D. A. Corcoran. The company which he heads operates a 2000-barrel skimming plant, is a licensee of Universal Oil Products Company, and is changing the cracking unit over to Dubbs single coil operation with provision for change to two-coil operation being provided fr

Murray Edmiston had his first refine / experience with Great Western Oil Refining Company at Erie, Kansas, during his school vacation periods in 1906, 1907 and 1908. In October, 1919, he became general manager of that company working under John M. Cameron. September 1, 1920, he became superintendent for Ranger Refining & Pipe Line Company, Ranger, Texas. Seven months later he returned to Erie, Kansas, and started a compounding plant, and in February, 1923, went to Ardmore, Oklahoma, as superintendent of Cameron Refining Company, organized by John M. Cameron, his former boss at the Great Western plant. When the Cameron refinery was taken over and made part of the Wirt Franklin Petroleum Corporation, Edmiston continued in the capacity of superintendent until November 1, 1931. In February, 1932, he became vice president and general superintendent for Blackgold Refining Company.

Herbert Joins White Star

JAMES H. HERBERT, formerly assistant manager of public relations for Standard Oil Company of Ohio, has been appointed director of industrial relations for the White Star Division of Socony-Vacuum Oil Company, Inc., at Detroit, Michigan. Herbert has been active in safety work in refineries for several years. He has but recently retired as president of the Fire and Safety Marshals of the National Petroleum Association, a position he has held for nine years. He is now chairman of the executive committee of the group.

JAMES H. HERBERT

Prior to his connection with Standard Oil Company of Ohio, Herbert was assistant manager of Conewango Refining Company, Warren, Pennsylvania. It was while he was with Conewango Refining Company that he secured the interest of eastern refiners for his leadership in promotion of safety work in the refinery. As a token of esteem he was tendered a luncheon before leaving Standard Oil Company by 110 office and refinery workers, who presented him with a complete set of golf togs and accessories.

C. R. Vegh-Garzon (right), chief engineer, petroleum department, ANCAP, Montevideo, Uruguay and G. Wallace Miller, Universal Oil Products Company

▼ PLANT ACTIVITIES ▼

Combination Unit: Magnolia Petroleum Company, Beaumont, Texas, is preparing foundations for its new 30,000-barrel combination crude distillation and cracking system. Contract to M. W. Kellogg Company.

Solvent Plant: Gulf Refining Company, Port Arthur, has completed installation of a 1000-barrel Multi-Sol solvent refining process using benzol and methyl-ethyl-ketone. The company will soon start erection of its 9000-barrel furfural solvent refining installation.

Asphalt Plant: The Texas Company, Port Neches refinery, has completed installation of equipment for doubling capacity of its asphalt plant. At Port Arthur the company is preparing to install a furfural solvent refining process, as previously reported in these columns.

Enlarging: Shell. Petroleum Corporation, Houston refinery, is reported completing construction of its plant for manufacture of Iso-Octane and polymerization unit. Plans also for new cracking unit and new crude oil distillation unit of large capacity.

New Unit: The Pennzoil Company, Oil City, Pa., has let contract to Alco Products, Inc., for construction of a modern 4000-barrel pipe still distillation unit. Construction will begin at once.

Distillation Unit: Anglo-Persian Oil Company, Abadan, Persia, has let contract for construction of the world's largest distillation unit, to process 65,000 barrels daily. Light products are to be topped from crude in vacuum operation. Contract to E. B. Badger & Sons Company and most of the equipment furnished by English concerns. The Abadan plant capacity is 125,000 barrels daily.

Refinery: Ithaca Refining Company, Ithaca, Michigan, plans construction of a 1000-barrel skimming plant 15 miles east and two miles north of the new Crystal townsite, Montcalm County oil field. J. F. McKinney and J. O. Beet, Ithaca, are backing the project. Company capitalized at $80,000.

Operate: Cusco Oil & Refining Company, with general offices at Wichita, Kansas, and which was recently formed by Frank Unruh and I. W. Siegel, has purchased the shutdown 3000-barrel skimming plant of Security Petroleum Corporation at Chase, Kansas. To operate at 1000

barrels per day. Ben Taxman is general manager, with offices at Chase. Jess Hughes is superintendent.

Rebuilding: Canfield Oil Company, Corapolis, Pa., which was partially destroyed by fire last month, is being rebuilt under contract by The Austin Company. Fire damaged only the filter plant and barreling plant. The new filter plant will be modern pressure type. The remainder of the plant was not severely damaged, most of it being unaffected.

Refinery: Standard Oil Company of California, operating as Standard Oil Company of British Columbia, at Burrard Inlet, near Vancouver, has purchased a 55-acre site for establishment of a 2500-barrel refinery to cost about $1,000,000. Project includes wharfs for crude oil terminal and several service stations.

Treating: Atlantic Refining Company, Philadelphia, is installing a new clay treating system at its refinery.

Cracking: Shell Petroleum Corporation is progressing rapidly in its modernization program at Wood River, involving erection of a large capacity combination skimming and cracking process and its new solvent refining unit.

Cracking: Wadhams Oil Company, East Chicago, Indiana, is erecting a new combination crude distillation and cracking plant. Contract to M. W. Kellogg Company.

Refinery: Gulf Refining Company is mentioned in reports as planning construction of a new refinery at Curtis Bay, Baltimore, Maryland. Definite construction details, it is said, will be available soon.

Gasoline Plant: Carter Oil Company, Tulsa, is moving equipment from Seminole plant to Fitts, where it is building a 25,000-gallon natural gasoline plant. Operation scheduled to begin about October 1.

Crude Stabilizer: Iraq Petroleum Company has let contract to Foster Wheeler Corporation for erection of a crude oil stabilization plant near the Kirkuk field. Includes distillation unit and accessories for the removal of fixed gases and hydrogen sulphite. Pipe line is handling around 85,000 barrels daily. Reported cost of stabilization system, $1,000,000.

Refinery: Amtorg Trading Corporation, New York, has given contract to Alco Products, Inc., covering equipment for a 12,000-barrel refinery at Ufa, Baskkirian Republic in southern Urals, U. S. S. R. Reported cost $1,200,000. Equipment includes facilities for topping, cracking, reforming, treating, and the usual auxiliaries.

Addition: Howard County Refining Company, near Big Spring, Texas, has enlarged capacity from 1500 to 2500 barrels per day through addition of a new tube still.

Plant: Devenish Petroleum Ltd. Skiff Field, Southern Alberta, Canada, has completed its specially designed plant for production of tractor fuels from heavy Devenish crude.

Cracking: Azienda Generale Italiana Petroli (A. G. I. P.), Mestre, near Venice, Italy, is rebuilding and enlarging its distillation and Dubbs cracking facilities to produce 1800 to 2000 barrels of gasoline daily. Contract to Foster Wheeler Corporation.

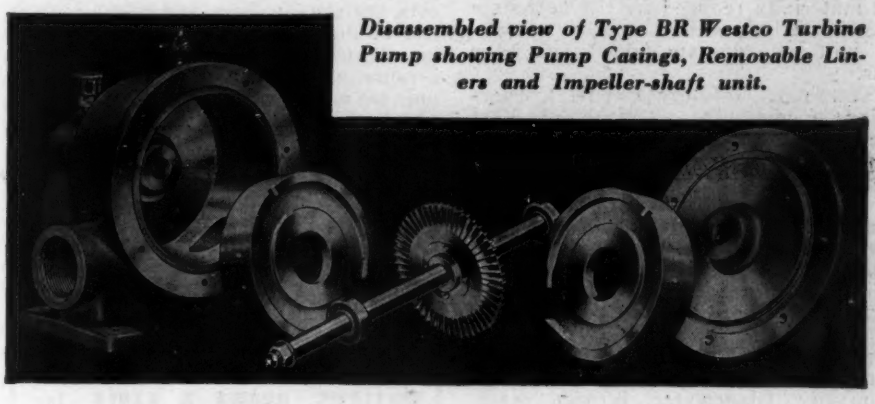
Move Refinery: J. R. Travis, Duncan, Oklahoma, is reported planning to move a 3500-barrel refinery from Duncan to Russell, Russell County, Kansas, if sufficient crude contracts can be arranged.

Terminal: The Texas Company is reported planning construction of a loading terminal at Brownsville, Texas, to provide facilities for handling upward to 50,000 barrels daily, including tankage, car loading equipment, and docks.

Pipe Line: Cortez Oil Corporation has let contract to Hope Engineering Company for construction of six-inch welded pipe line from Samfordyce field, Hidalgo County, Texas, to deep water loading facilities on the Brownsville-Port Isabel channel. Line is 85 miles long, 11,000 barrels capacity and project includes pump stations and working tankage.

Gasoline Pipe Line: Keystone Pipe Line Company, subsidiary of Atlantic Refining Company, is building 180 miles of eight-inch gasoline line from Mechanicsburg, Pa., to Pittsburgh, and project includes a number of pump stations and working tankage.

Improvements: Associated Oil Company, Avon refinery, Associated, California, has let contract to Braun Corporation for construction of stabilizer



Disassembled view of Type BR Westco Turbine Pump showing Pump Casings, Removable Liners and Impeller-shaft unit.

Longer Life from Pump Casings

New Westco Feature saves money for pump users

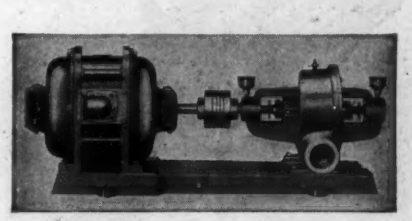
PATENTED Removable Liners now provide a complete lining for Westco Pump casings. These Liners form the liquid channel and are quickly and easily removed from the casings. Besides protecting the casings against possible wear and corrosion, Removable Liners have 3 other valuable advantages. They are:

1. *Less metal required for alloy construction.*
2. *"Stand-by" pump protection at about ¼ usual cost.*
3. *Capacity of pump can be increased or decreased.*

Superior Construction

All Westcos have a double-suction intake which creates a perfect hydraulic balance within the pump. Casings are vertically split for quick, easy removal of Liners, Impeller-shaft unit and bearings (complete disassembly) without disturbing suction or discharge connections.

These pumps are favorites throughout the industry for Still Charging and for handling Hot Oil, Fuller's Earth, Chlorine Treating Solutions, Mineral Seal Oils, Naphtha, Chemicals, Brine, Water, etc.



Type BR Westco Turbine Pump

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and fractionator unit at reported cost of $100,000. Alco Products, Inc., has nearly completed the new butane recovery plant. Reconstruction of the re-run unit was begun earlier in the year and E. B. Badger & Sons Company is contractor. This firm is also building addition to the crude unit to increase lubricating oil and asphalt production.

Natural Gasoline: Shamrock Oil & Gas Company, Amarillo, Texas, is enlarging its well pressure absorption type natural gasoline plant in the Dumas-Sunray district, Moore County, Texas Panhandle, from 110,000,000 to 133,000,000 feet daily. Some of the equipment will be taken from the company's plant on the Clayton land near LeFors, Gray County, as the available gas supply for the latter will be materially reduced by the new state gas waste law, while the Moore County unit will operate largely on sour gas.

Terminal: Refinery Export Corporation, formed by a group of East Texas refiners last November, has been re-organized and the name changed to Independent Terminal Company following recent purchase of Sinclair Refining Company's tank farm, involving 340,000 barrels of steel storage tanks, and tanker loading facilities at Texas City, Texas. M. M. Travis, head of Southport Petroleum Company, Kilgore, is president of Independent Terminal Company. C. Ray Starnes, owner of Texas Oil Products Company, Gladewater, is vice president. Tom Potter, an official of Utah Refining Company, Kilgore, and J. H. Campbell, Gilliland Refining Company, Gladewater, are treasurer and secretary, respectively.

Dismantle: Magnolia Petroleum Company has sold its auxiliary refinery, formerly operated by White Eagle Oil & Refining Company, at Fort Worth, Texas, for dismantling. The plant was rated at 2600 barrels capacity, with a small cracking unit.

Gasoline Plant: Trio Refining Corporation, headed by M. J. Grogan, Shreveport, La., operating a skimming and cracking plant in the East Texas field near Arp, is planning to erect a natural gasoline plant in the field.

Lomita's Whiskered Mascot

Many natural gasoline plants have mascots, but step up, boys, and take a look at one of the pets the Lomita boys think a lot of. Charlie's his name, and he got it because of the distinction of being the only cat in captivity with a moustache like Charlie Chaplin's.

Charlie was born in a rubbish box near Texaco's Plant 5B and was cared for by the Texaco boys. His kitten days were spent sleeping in the foremen's office, or lying in the sun near the zeolite softeners. Sometimes he took strolling journeys around through the equipment, smelling accumulators or batting at the foam in the cooling tower pits.

But one thing about Texaco's plant stalled him. Everywhere, to the right, or left, the ground was a solidly packed mass of crushed rock about two inches thick. Baffled by this peculiar resistance offered by Mother Earth, Charlie found himself faced with a problem he felt no other cat had ever encountered. His mother had explained to him what it was that made wild cats wild, and he began to fear that if the one great privilege peculiar only to cats was to be withheld from him indefinitely by Texaco, he'd have to break off with them and find a new home.

Charlotte, nee Charlie!

So one bright day Charlie packed up his belongings, hitched up his tail, took one last look at his birthplace, and started out to find a new home. Another cat had told him of a place called the Lomita Gasoline Company, where the ground was nice and soft, so he headed across the road in that direction. He soon detected the familiar gasoline and oil smells, and entering a gate found himself in what he considered paradise. Everywhere was soft brown soil! Charlie's heart sang with joy as he surveyed its possibilities.

* * *

Ever since, Charlie has lived contendedly with the Lomita boys. He likes them and they like him. Only one incident came up that had to be adjusted—and that was when he bore a litter of six kittens.

So Charlie's name is now Charlotte.

EDITOR'S NOTE: If you missed clipping this for the technical files when it appeared in Petroleum World, June, 1935, reprinting it here gives a second opportunity. And to Russ Palmer, Editor, thanks for the loan of the engraving, and the story—and we wonder with you as to who wrote the gem? 'Tis said that Julian Campbell, genial general manager for Lomita, had naught to do with any of it. And if any reader knows of other interesting mascots, let's have the picture and the story.

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▼ BUSINESS NOTES ▼

R. J. DEARBORN, patent counsel of The Texas Company, has resigned from the presidencies of Process Management Company and Gasoline Products Company and became chairman of the board in each instance. In giving up his active work in directing these companies he will be in position to devote more of his time to his regular duties as patent counsel for The Texas Company.

William F. Moore was elected president of Process Management Company and president of Gasoline Products Company at the June meeting of the board of directors. His election to the presidency was from the post of vice president and general manager, which he has occupied for some years. As president he will be in executive charge of all matters pertaining to Process Management Company and for the two companies which it manages, namely, Gasoline Products Company and Gray Processes Corporation. In its work pertaining to process and patent research and licensing, Process Management Company acts for its affiliates, Standard Oil Company (Indiana), The Texas Company, The M. W. Kellogg Company, and its managed companies, Gasoline Products Company and Gray Processes Corporation.

Other officers elected at the June meeting were as follows: W. H. Sullivan, vice president and treasurer; Pike H. Sullivan, secretary; J. H. Speyer, assistant secretary; H. A. Bonyun, Jr., assistant treasurer.

Pike H. Sullivan as general patent attorney of Process Management Company, will be in direct charge of all its patent and contract matters, including those of its two managed companies.

W. H. Sullivan will be in direct charge of all financial, accounting and tax matters pertaining to Process Management Company and its two managed companies; also continuing as office manager of Process Management Company.

A. J. WADHAMS, manager of development and research, The International Nickel Company, Inc., has announced the addition of O. W. McMullan to the research staff. He will be located in the research laboratory maintained by the company at Bayonne, N. J.

McMullan was formerly chief metallurgist at the Timken-Detroit Axle Company, Detroit. Prior to that time he was with Studebaker Corporation. He is a graduate of the University of Michigan where he also took his degree as Master of Science. He is well known in metallurgical circles, principally through his authorship of numerous papers, both by himself and jointly with H. W. McQuaid, all of which have been presented before the American Society for Metals.

KENNEDY Valve Manufacturing Company announces appointment of Thomas C. Swope as Texas and Louisiana representative, with headquarters at 863 Fifth Street, Beaumont, Texas.

LOUIS H. BRENDEL has joined Consolidated Ashcroft Hancock Company, Bridgeport, Connecticut, as assistant sales manager of the Hancock Valve Division. He will assist M. S. Palmer, sales manager, in the promotion and sale of a new line of valves. For the past two years Brendel has been an account executive with the Sutherland-Abbott advertising agency, and prior to this he spent several years advertising and selling valves and industrial control equipment.

THE Holley Medal for 1934 was awarded on June 20, at the semi-annual meeting of the American Society of Mechanical Engineers at Cincinnati, Ohio, to Dr. Irving Langmuir, associate director of the General Electric Research Laboratory, for his contribution to science and engineering, especially in the development of the gas-filled incandescent lamp, of the thoriated filament for thermionic emission, of atomic-hydrogen welding, of phase-control operation of the Thyratron tube, and in fundamental research in oil films.

The Holley Medal was instituted and endowed in 1924 by George I. Rockwood, past vice president of the A.S.M.E., to be bestowed for some great and unique act of genius of engineering nature that has accomplished a great and timely public benefit. It was awarded to Hjalmar Gotfried Carlson in 1924; to Elmer Ambrose Sperry in 1928; and to Baron Chuzaburo Shiba in 1929.

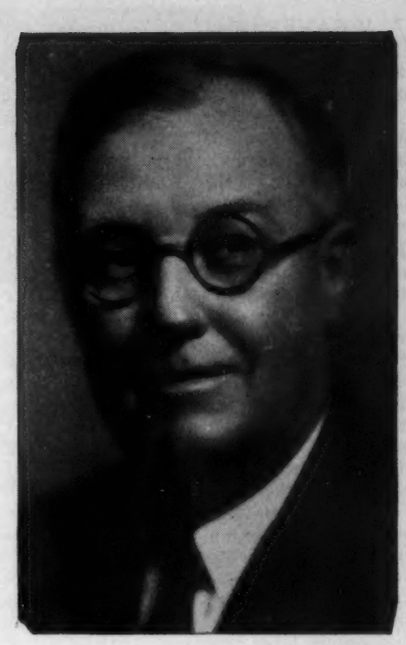
Dr. Langmuir presented a paper at the meeting entitled "The Mechanical Properties of Matter", in which he discussed the opportunities for men trained in physics to make vital contributions to industrial progress.

AN announcement from the general offices of National Radiator Corporation at Johnstown, Pa., states that a second patent has just been issued on National Oil-Rators, one of the company's recent products.

The National Oil-Rator is an industrial heating unit used primarily by petroleum producers in the dehydration of crude oil emulsions. A prior patent granted to Thomas A. Novotney and Louis N. Hunter, member of the Research Department of National Radiator Corporation, covers the use of this equipment for that purpose.

The latest patent, also granted to Novotney and Hunter, assignors to the company, covers the use of the Oil-Rator for general heating purposes other than the treatment of oil emulsions.

THE Filtrol Company of California has moved its general sales offices to 315 West Fifth Street, Los Angeles. The change was made to expedite and simplify sales contacts with the various refining organizations.



A. P. GREEN

A. P. GREEN, president of A. P. Green Fire Brick Company, Mexico, Missouri, was awarded the honorary degree of doctor of engineering at the recent commencement exercises of the Missouri School of Mines, Rolla, Missouri.

A. P. Green Fire Brick Company recently celebrated its silver anniversary, this being the 25th year in which the company has been engaged in business. Beginning with the purchase of a very small plant, by Mr. Green in 1910, the history of the A. P. Green Fire Brick Company is a record of consistent advancement and achievement.

FRICK COMPANY, manufacturers of refrigerating machinery at Waynesboro, Pennsylvania, announce the appointment of Henning N. Borgstedt as manager of its branch office in New York City.

Borgstedt, after receiving his diploma in mechanical engineering in Sweden, many years ago, came to this country and started with the De La Vergne Machine Company in New York. He held the following positions in the Refrigeration Division of De La Vergne: draftsman, district engineer in the Middle West, chief draftsman, manager of the New England district, including the eastern part of Canada, chief engineer, vice president of Canadian De La Vergne, Ltd., and sales manager. He is a member of both A.S.R.E. and A.S.M.E. He commenced his new duties with Frick Company July 1.

D. R. DAVIS, with headquarters in Wichita Falls, has been appointed to represent The Lunkenheimer Company, Cincinatti, Ohio, in parts of Texas and Oklahoma. E. R. Tieberman, who formerly traveled this territory, will transfer his activities to Tulsa, from which point he will cover Oklahoma and parts of Kansas. Joseph Waldeck, for many years a representative in the Mid-Continent and Texas fields, will act in a supervisory capacity over both territories.

V. WEAVER SMITH, prominent for the past 10 years in connection with heat engineering problems of the oil industry, became vice president in charge of the business activities of Broderick Manufacturing Company, Muncie, Indiana, May 1. He has resigned his position as assistant to the president and head of the oil heater department of The Lummus Company, New York.

Following a number of years of chemical experience during the world war period and four years as works manager of Atlantic Tar and Chemical Works, Ltd., Elizabeth, New Jersey, Mr. Smith entered the industrial steam engineering field with Superheater Company in 1926. While with this organization he introduced and developed the application of superheated steam in the cotton seed oil industry. Later he directed a series of field tests on the use of superheated steam in drilling oil wells. The results of these tests, presented in a paper before the national petroleum meeting of the American Society of Mechanical Engineers in October, 1930, provided a basis for the important place in the industry which this development later assumed.

Mr. Smith's work on oil heaters in connection with petroleum refining while with the Superheater Company was also of wide industrial significance. When The Lummus Company was acquired by Superheater Company and Babcock and Wilcox Company in 1930, Mr. Smith became assistant to the president of The Lummus Company and continued in charge of the work on oil heatrers.

The Broderick Company is the oldest and largest manufacturer of oil country boilers, having been supplying equipment

V. WEAVER SMITH

to the oil industry for 47 years. It now intends to extend its activities, and Mr. Smith will direct this work.

J. HENRY ESSER, president of Suburban Fuel Oil Service, Inc., of Mt. Vernon, New York, and its affiliated companies, the Petroleum Storage Corporation and Suburban Petroleum Products Company, Inc., now is in Houston, Texas. He is making his annual visit to Houston in the interest of his companies to generally look over the production and manufacturing operations of heating oils carried on principally by refineries on the Houston ship channel. This year his stay is prolonged by Suburban Fuel Oil Service's new activities.

Under the personal supervision of C. M. Johnson, consulting petroleum engineer of Houston, a new and novel manufacturing operation is being conducted here, designed to produce quality heating oils to suit the New York trade. These oils, it is announced, are to be produced from selected Gulf Coast crudes, manufactured with the care usually devoted to lubricating oils. The Suburban companies are large distributors of heating oils in New York City, and its suburban territory, extending well into Connecticut, and have for years specialized exclusively in that branch of the petroleum industry.

Because of this specialized nature of its business the company feels it is justified in departing from the customary method of refining heating oils as a by-product to gasoline, and the new operation is designed to produce absolutely no gasoline, and only a very small percentage of the very light distillates.

It is admitted that such an operation would not be as remunerative to the refining industry generally as the usual production of as large a gasoline cut as possible, but inasmuch as Suburban does not seek to develop profitable outlets for the sale of gasoline, the company feels that it can afford to refine these selected crudes into fine heating oils for the exclusive use of its own retail customers who desire heating oils of the highest quality.

Pressure Base Bulletin

CONFUSION is frequently encountered when comparing or computing gas volumes measured by orifice meter because of the different absolute pressures and pressure bases in common use. With the objective of eliminating confusion and arriving at a standard by which a cubic foot of gas is definitely specified, so that measurements at any place, or any elevation, can be given in terms of that cubic foot, the California Natural Gasoline Association published Bulletin S-282 on an "Absolute Pressure for Natural Gas Measurement" (revised April, 1929.)

The product of a committee headed by F. E. Huff of the Standard Gasoline Company and made up of representatives of 14 California companies, the publication is complete with all of the data necessary for field application. Describing in detail the importance of using an absolute pressure base, it then deals with the effect of different pressure bases on fuel comparisons. Complete tables of standard hourly orifice coefficients for a full range of orifice sizes and pipe diameters are given, together with specific gravity and flow temperature multipliers. Calculated values of Cv for 2½ and 8 diameter line and flange connections are shown, along with two tables of computed barometric pressures for various elevations.

Copies of this bulletin are available at 25 cents each, through the association secretary, 1217 Associated Realty Building, Los Angeles, California.

Fleming Process Inventor Dies

RICHARD FLEMING, inventor of the Fleming process of cracking, died at his home in Burlingame, California, June 16, after a brief illness. He was 69 years old. The Fleming process was one of the earliest processes employed by the refining industry.

Fleming's early business life was in the electrical and electro-chemical industries and he was the holder of many patents in this field. Shortly before the World War he became chief engineer for Aetna Explosives Company which was experimenting with production of toluol by cracking. Out of this experience he devised a cracking process applicable to petroleum refining which was used by many refining companies.

A. P. I. Accident Prevention Manual

THE American Petroleum Institute, department of accident prevention, 1508 Kirby Building, Dallas, Texas, announces availability of A.P.I. Accident Prevention Manual No. 8, First Edition, "Bulk Plant Operation and Delivery of Products." This 16-page bulletin contains much of interest and value to the refiner as well as the marketer of petroleum. The price is 25 cents per copy.

SAVES 25% ON OVERNIGHT JOB!

To remove a thick viscous incrustation of tar petroleum from tin oil test cups, one company tried burning out by heating, then soaking overnight in a light solvent, followed by laborious hand scrubbing.

Results were not satisfactory. Then a NEW method was tried. After first melting and flowing out the heavy deposit, the cups were soaked overnight in solution of one of the Oakite materials and were then boiled for an hour in solution of a second Oakite material. After a cold rinse and wiping with rag, a 100% job was secured. Easier . . . cost saving estimated at 25%.

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EFFECTIVE INSULATION

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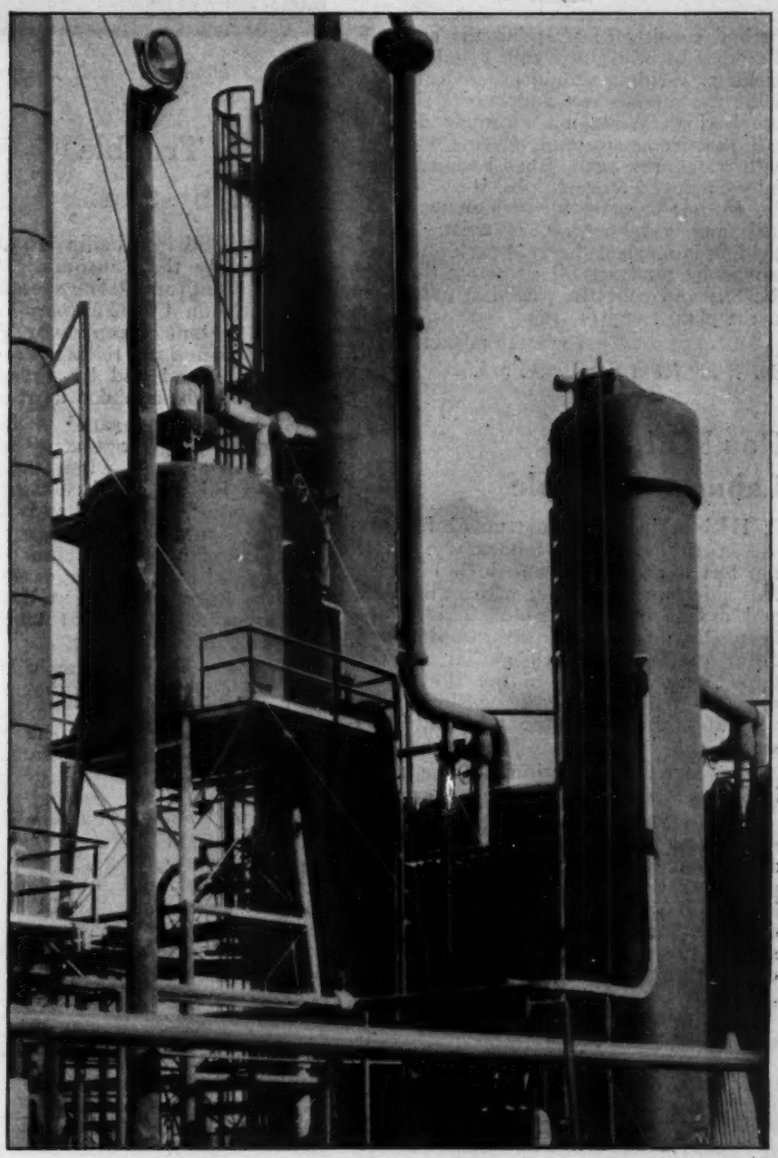
Typical insulating job planned by the Eagle-Picher Contracting Division. This topping unit was insulated with Eagle Blankets, Eagle "66" Plastic Insulation and Eagle Insulseal (waterproofing cement). Pipes were insulated with Eagle "77" Pipe Covering and Eagle "55" Block Insulation.



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When the engineers in our Contracting Division are called in to study a job, they have a wealth of practical experience in the oil fields to guide them in their recommendations. They supervise all work as it is being done with Eagle insulating materials.

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Eagle "66" Plastic Insulation. Plastic insulation, easily applied, extremely effective for temperatures as high as 1800° F.

Eagle Blanket Insulation. Insulating wool felted and secured, for boilers, breeching, oil refinery equipment, furnaces.

Eagle Stalistic (boiler setting cement). Durable coating protects all heat insulation against deterioration.

Eagle Fireproofing Concrete. High grade insulating concrete that furnishes dependable fireproof protection to structural members.

Eagle "99" Finishing Cement. Easily applied, efficient, adheres to hot or cold surfaces, dries hard, durable.

Eagle Asbestos Lumber. Structurally strong, fireproof, resists heat and weather.

Eagle "77" Pipe Covering. Insulating wool felted and secured, flexible and easily applied. Particularly adapted for hot lines where a cement finish is desired.

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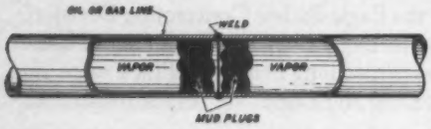
IDEAS

Mud Plugs for Welding Safely

THE accompanying illustration indicates a simple method of preparing pipe which may have been used in natural gasoline or vapor recovery plants and which contain volatile or combustible vapor, so that it may be welded with safety. The



method consists of plugging the ends of the pipes to be welded with suitable mud packing. Welding should proceed at once while the mud is wet and before shrinkage begins. While not recommended as safe practice as steaming out and washing with water, the method has been successfully employed on rush jobs. It overcomes the natural hazards where high temperature and gasoline vapors exist. After welding is finished the mud packing is removed by pumping oil or water through the line and collecting the first pumpings at the plant sump or trap.

E. OSPINA-RACINES,
301 West 108th St., New York.

Road-Oil Laboratory Table

THIS table was constructed for use in the road oil laboratory. The top has a projection one inch high on two sides and one end, while the other end drains into the sink. This is to keep the drippings from samples and other materials, which gather on the table, from running on the floor and, also, to permit ease in washing the accumulations from the table into the sink.

The steam connection on the table is for the purpose of heating samples.

The sewer connection, from the sink, has a steam connection with valve arrangement, so that steam may be passed to the sink in order to heat the heavy oil that may stop up the drain, or the steam may be directed into the sewer to aid in cleaning the sewer connection. W. N. E.
Arkansas City, Kans.

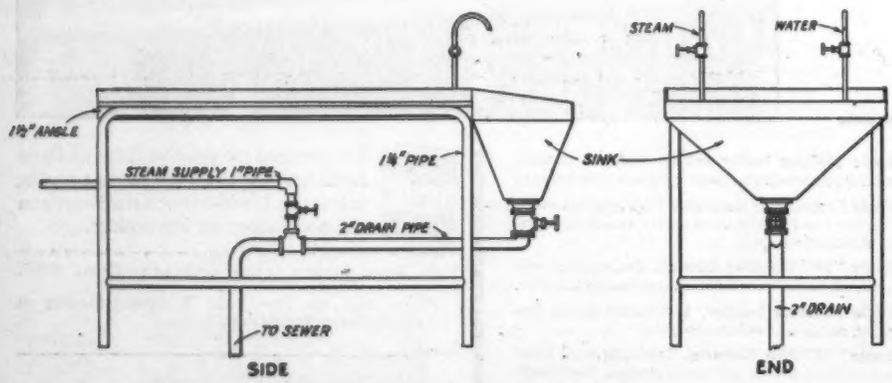
Double Trouble Alarm

Double Trouble Alarm System

WHEN drips begin to fill more rapidly than automatic traps can empty them, an alarm system, installed by Union Oil Company in its Bell gasoline plant compressor room, begins to function, telling the operator both by sound and by sight that difficulty must be attended to at once.

Electrically operated switches are connected to the operating mechanism of the drips, and when the fluid begins to fill above a certain predetermined point, the contact is made and the lights and horn both go on at once. The company electrician devised a method whereby the operator can cut out the horn at will, but the red light continues to show that trouble is on and where it is.

More than one system is in use. One is attached to the scrubbers on both ends of the plant intake, another to the accumulator drum, the plant pressure supply and at various other points. Trouble is experienced at this plant, just as at every other gasoline plant, but when the horn sounds, and the red light appears, the operator knows exactly what the trouble is, and where to go to eliminate it. Without this system, drips could fill up and overflow without the operator being aware of the fact until the compressors began to pound, and that sometimes, is too late. J. C. A.



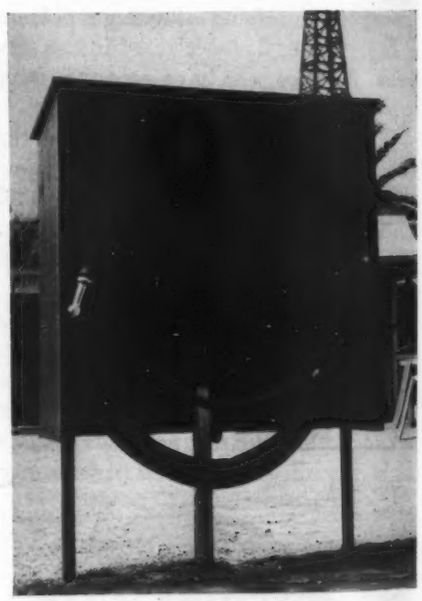
ROAD-OIL LABORATORY TABLE

Removing Hot Slag From Boilers

CAREFUL experimentation has demonstrated that where slag forms and bakes onto the lower row of tubes of water tube boilers, as it sometimes does, cold water is effective for its removal. It is better than steam, which is commonly used. The reason for the breaking up of the slag with cold water is the same as the reason for the breaking of hot dishes and glasses when suddenly cooled. The cold water causes the slag to crack and fall off in large pieces. In these tests it was also found that freeing the tubes of slag increases the chimney draft, helps maintain high efficiency, and saves much money due to the time previously required for laying up and cleaning boilers. Now the cleaning is done while the boilers are in operation. During the cleaning process the temperature of the flue gases was reduced approximately 15 degrees. The cold water was introduced into the boiler and onto the hot slag by means of an old-fashioned hand lance.

However, it is important to exercise care in introducing the cold water so that it will not touch the furnace walls. Cold water on a hot wall will crack the wall as readily as it will crack the slag. The water must be confined to the slag only.

W. F. SCHAPHORST,
45 Academy St., Newark, N. J.



Protected Fire Hose

Protect Fire Fighting Facilities

TO ASSIST in preventing the spread of gasoline fires, O. C. Fields Gasoline Corporation has installed a water system which delivers a mass of water vapor in the form of a dense fog to the point of combustion. Water lines were laid throughout the plant yard with connections at three points. One is near the boiler room, another opposite the distillation unit and the other beside the storage tanks. All of the service connections are placed about 30 feet from the units which they were designed to protect.

Because of the mild weather in Cali-

fornia, it was not necessary to build frost boxes, so the service pipes extend from the buried pipe line to the surface of the ground where a hose is connected by using the usual hose-to-pipe threaded couplings. The hose is a permanent fixture and is coiled upon a support built from pipe set in the ground and supporting a cover for the hose. The side of shelter is open where the hose is coiled, but is closed on the other three sides to protect the rubber from the sun. A slanting roof of galvanized corrugated iron is used to protect the coil from rain.

To use the equipment, the operator turns on the water by operating a quick opening gate valve and drags the hose to the point of use. The nozzle is built so the water is broken up in a fine dense mist which smothers fire by shutting off the supply of air from the material which may be burning.

J. C. A.

When to Add Fresh Hypochlorite Solution

A CONSIDERATION of the qualities of a well finished natural gasoline should include the quantity and character of the sulphur compounds it contains, so among the specifications formulated by the Natural Gasoline Association is the requirement that this product must be "sweet" on a 10 c.c sample.

This quality of "sweetness," as is well known, is rather a relative term, for a gasoline may give a negative test (sweet) when 10 c.c. are treated with 5 c.c. of the doctor solution and sulphur, but a positive test (sour) when 15 c.c. or more of the same product is treated in the same manner.

In view of this fact it is suggested that a fresh charge of hypochlorite be added to the treating tank of the sweetening system when the gasoline shows sour on a 20 c.c. sample; for the following reasons:

First, there will be less likelihood of the product being sour or slightly so when marketed.

Second, the product will be more desirable for blending, for should the blending stock be slightly sour, the use of a natural which is sweet on a 20 c.c. sample in the blend would help to rectify the sour condition.

Third, if the hypochlorite solution is "kept up" to this strength there is less likelihood of its breaking down either for want of alkalinity or exhaustion of the chlorine content.

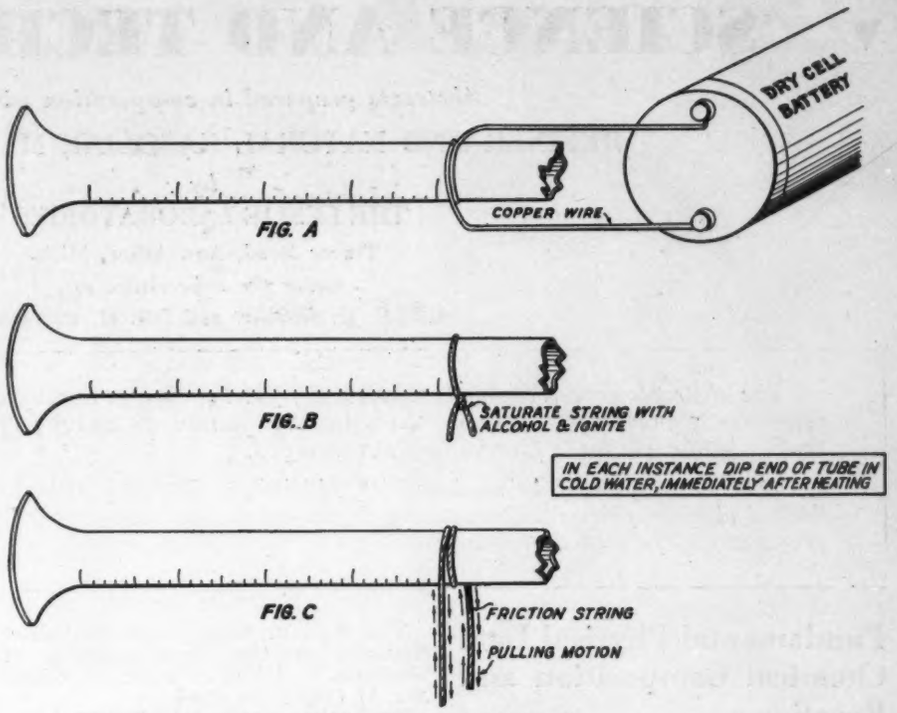
Fourth, less hypochlorite will be required to sweeten the gasoline, at least, we were so advised by a large distributor of this product.

HENRY COONEY,
Sugar Grove, Ohio.

Reconditioning Laboratory Glassware

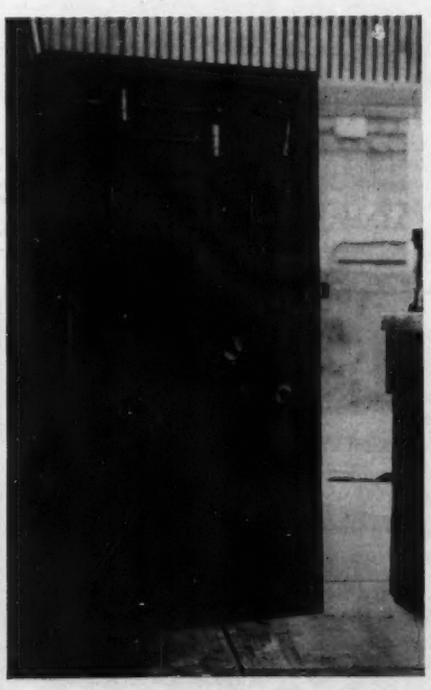
PARTIALLY broken graduates may be reconditioned to good advantage by breaking off the sharp cutting edge. The principle of cleanly cutting off the end of a graduate or similar laboratory glassware to render it safe and serviceable is to heat the graduate at the point where clean cut is desired and upon doing this to suddenly cool the particular spot.

In the accompanying diagram the method is indicated. Wrap a copper or nickel wire around the cylinder and connect the ends to a storage battery. After a few seconds of heating remove and plunge into cold water. A clean cut will result. Another method is to saturate a piece of string with alcohol, wrap it around the cylinder and apply a match. Cool suddenly as before after a few seconds of burning. A third method which is more adaptable and just as practical is to heat by friction. Take some wire, such as used for picture hanging or a string and place a loop around the graduate. Rest the cylinder horizontally at the edge of a table and quickly rotate the loop and press, by the two ends of the string, for about five seconds. Immerse suddenly in cold water and a clean break will occur. The latter method requires the assistance of a second person while the alcohol and string may be done alone.



METHODS USED IN RE-CONDITIONING TEST TUBES

E. OSPINA-RACINES.
301 W. 108th St., New York.



One way to keep tools. A place for each tool and each tool in its place

Special Tools in a Special Place

TOOLS needed in servicing machinery are seldom where they can be found, especially special wrenches for flush set screws and bolts not accessible to other types of wrenches. Kettleman North Dome Association recently built a completely new booster station and supplied the necessary tools for servicing the machinery.

These special wrenches were placed on a door of one of the supply cabinets. The door was "surveyed" to determine the size in relation to the number of wrenches to be hung in position, and screws placed in the wood upon which the wrenches can be placed. Tools which cannot be hung in this position are slipped into pockets and straps so they will always be ready for use.

When the door is closed, the tools are not exposed, but are always ready for instant use. The general arrangement may be changed to meet individual conditions, and boards of like nature could be constructed on pipe supports having casters so the assembly may be rolled to any part of the engine room. It appears that an ideal installation would be several boards placed on the same frame, hinged in the same manner as the boards on multiple display racks are arranged. Any arrangement of this nature not only keeps the tools in good condition but makes a place for each tool, so each tool can be kept in its place.

J. C. A.

SCIENCE AND TECHNOLOGY

Abstracts prepared in co-operation with the

REFINER AND NATURAL GASOLINE MANUFACTURER

by

THE LESLIE LABORATORIES

Traver Road, Ann Arbor, Mich.

under the supervision of

DR. E. H. LESLIE and DR. H. B. COATS

The abstracts here presented are selected from the current literature of science and technology to afford reference to fundamental information not easily available to all readers. Abstracts of articles appearing in readily obtainable trade journals are not included.

Photostat copies of original articles will be supplied at cost by the Leslie Laboratories. Complete or limited bibliographies covering special topics by tile, by abstract, or in complete manuscript, will also be prepared and furnished at reasonable cost by the Laboratories.

Fundamental Physical Data Chemical Composition and Reactions

Viscosity of Mixtures of Liquids at High Pressures. R. B. Dow. *Physics*, **6**, (1935), p. 71.

The effect of temperature and pressure on the viscosity of organic binary mixtures was studied by methods developed and used by Bridgman. The mixtures studied were (1) n-hexane-carbon disulphide, (2) n-hexane-ethyl ether, (3) n-hexane-n-decane, (4) n-hexane-phenol chloride, (5) n-pentane-benzene, and (6) eugenol-carbon disulphide. Mixtures (1) and (3) followed Arrhenius' empirical equation for the viscosity of a binary mixture. The other mixtures had an irregular isobaric concentration-viscosity curve. The viscosity of n-decane was also investigated as a function of pressure and temperature. Viscosity is a specific property of the molecule.

The Heats of Formation and the Stability of Chain Compounds. H. G. GRIMM AND H. WOLFF. *Angew. Chem.* **48** (1935), pp. 133-7

The heats of formation and equilibrium constants for the normal chain compounds of carbon, silicon, nitrogen, oxygen and sulfur with hydrogen were calculated. The results of the calculations indicate that long chain compounds are possible only for carbon and sulfur. As chain length increases, stability becomes less. With respect to the first member of the series, such as CH_4 or SiH_4, all members of the homologous series are thermodynamically unstable. Similar calculations for oxygen-containing carbon chains, such as carbohydrates and polyoxymethylenes, indicate that the energy conditions for chain formation of carbohydrates are highly favorable.

The Role of Methyl and Methylene Radicals in the Decomposition of Methane. L. S. KASSEL. *Jour. Am. Chem. Soc.* **57** (1935), pp. 833-4.

The experimental kinetics of methane decomposition cannot be explained by any mechanism that involves methyl radicals. The kinetics can be explained by the methylene mechanism. This involves decomposition of methane to give methylene and molecular hydrogen. Methylene combines methane to form ethane. Ethane decomposes into ethylene and hydrogen, ethylene to acetylene and hydrogen, and acetylene to carbon and hydrogen.

Direct Alkylation of Aromatic Hydrocarbons by Olefins Under the Catalytic Influence of Phosphorus Pentoxide. B. W. MALISHEV. *Jour. Am. Chem. Soc.* **57** (1935), pp. 883-4.

It has been found that aromatic hydrocarbons are readily alkylated by olefins in the presence of finely dispersed phosphorus pentoxide. Benzene is ethylated by means of ethylene at 250°C. and 27 atmospheres pressure. Mono- and hexaethylbenzenes were identified. t-Butylbenzenes are formed with benzene and isobutylene. p-Cymene is obtained by condensation of toluene with propylene. Naphthalene is ethylated to a liquid boiling between 210° and 322° that consists mainly of mono- and diethylnaphthalene.

The Production of Hydrogen from Hydrocarbons. C. MATIGNON AND M. SEON. *Rev. petrolifere, No.* **608** (1934), pp. 493-7.

The production of hydrogen by the conversion of hydrocarbons into hydrogen and carbon dioxide by reaction with steam was studied in experiments using a large excess of steam, in a silica tube at a temperature of 1000°C. The gas used contained methane 63.7%, nitrogen 14.4%, hydrogen 10.0%, carbon monoxide 7.3%, ethylene traces and oxygen 3.8%. Catalysts studied were ZrO_2, asbestos impregnated with ZrO_2, ThO_2, Fe_2O_3 and Fe_2O_3 + 10% K_2CO_3. ZrO_2 proved to be the best catalyst, the effluent gas containing approximately 74% hydrogen, 17% CO_2 and no carbon monoxide. The optimum temperature proved to be 1050°C. for methane, as well as for hexane, benzene, m-xylene, cyclohexane, cyclohexene, gas oil and fuel oil. When hexane, cyclohexane and cyclohexene were used, ethylene was formed in appreciable quantities when the time of contact was short.

Antiknock Effect of Tetraethyllead. J. M. CAMPBELL, F. K. SIGNAIGO, W. G. LOVELL, AND T. A. BOYD. *Ind. Eng. Chem.* **27** (1935), pp. 593-7.

Previous publications from the General Motors research laboratory have presented data on the knocking characteristics of a large number of hydrocarbons. It was found that hydrocarbons exhibit a range of knocking behavior that is very large as compared with present commercial fuels. On account of the wide use of tetraethyllead as an antiknock agent it is important to know its effectiveness in increasing the antiknock value of different individual hydrocarbon fuels. The data secured in the present work show that lead has a range of effectiveness in different pure hydrocarbons that is very large as compared with its effect in present commercial gasolines. Quantitative measurements of the specific antiknock effect of tetraethyllead when added to 62 individual hydrocarbons were made by finding the increase in critical compression ratio in a single cylinder, variable compression engine. Tetraethyllead was added in a concentration up to 1.0 cc. per gallon. On this basis there is a twenty-fold variation in the effectiveness of the lead in preventing knock in different hydrocarbons. Certain general relationships between hydrocarbon structure and susceptibility to lead, that appear to be consistent within the scope of the work done, are described.

Manufacture: Processes and Plant

Principles of Motor Fuel Preparation and Application. Volume I. A. W. NASH AND D. L. HOWES. *Book. Published by John Wiley & Sons, New York City.* 538 pp. $8.00.

The rapid development in motor fuel technology have justified the preparation of a new work on this subject. Volume I discusses distillation, cracking, natural gasoline, refining, hydrogenation, and benzol, alcohol and synthetic motor fuels. Volume II, in press, will review the relation between the physical properties of motor fuels and the performance of these fuels in the modern automobile engine. The book is well prepared and clearly written and will be found to be a valuable addition to the technical literature of the motor fuel industry.

The Handbook of Butane-Propane Gases. G. H. FINLEY. *Book. Published by Western Gas, Los Angeles, Cal.* 375 pp. $5.00.

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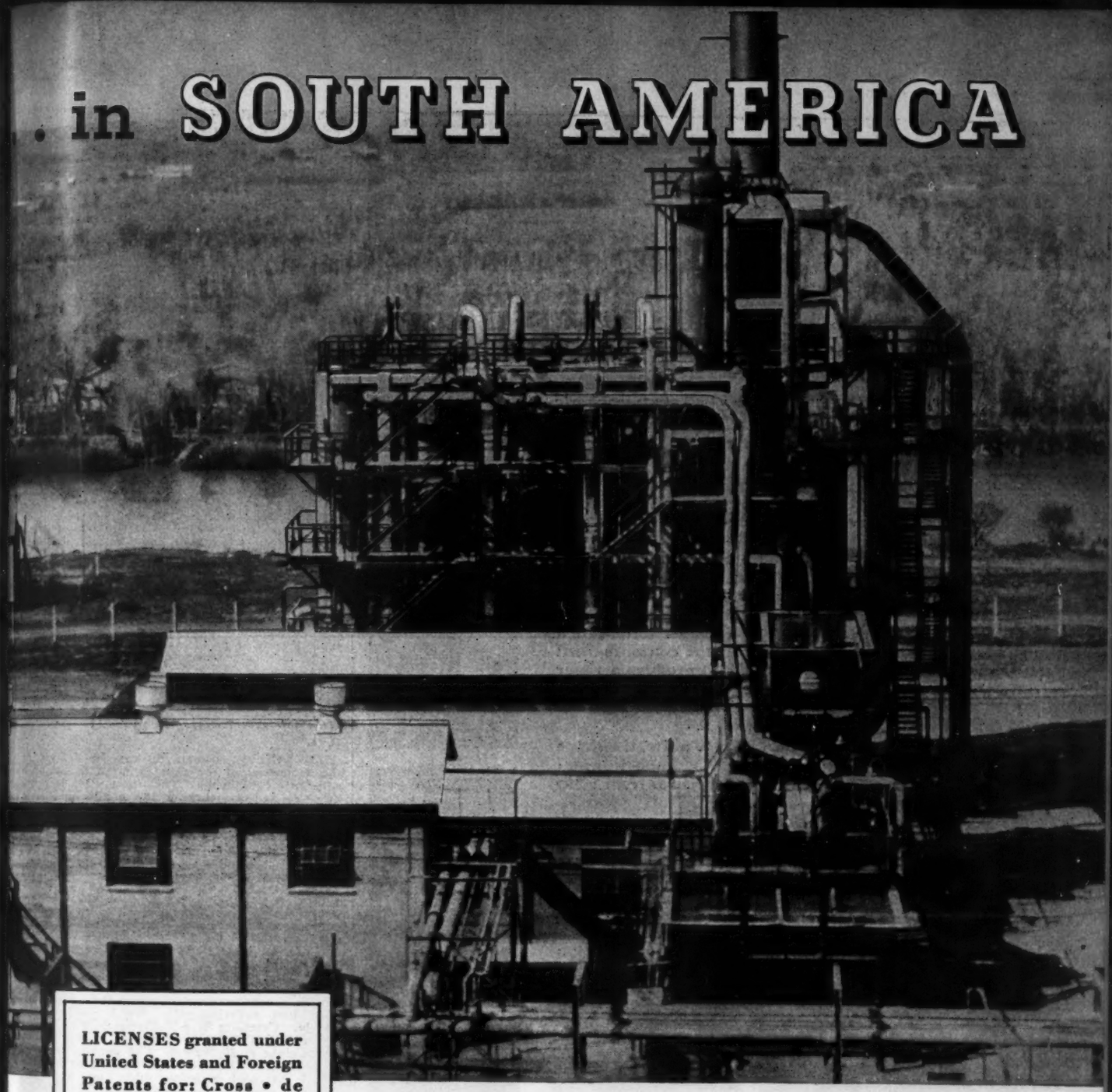

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a broader range of subject matter than the first edition. It comprises sixteen chapters written by engineers and technologists prominent in the industry and is thus based upon the experience of many producing and marketing organizations. Problems of production, transportation, storage, distribution, and utilization of propane and butane are covered. New material in this edition includes the application of these materials as internal combustion engine fuels, manufacture and physical properties of refinery produced liquefied gases, the design and construction of pressure vessels, and many miscellaneous supplementary data. A valuable feature of the Handbook is a bibliography of references related to liquefied petroleum gases.

Determining Efficiency of Continuous Mixers and Reactors. R. B. MACMULLIN AND M. WEBER, JR. *Chem. & Met. Eng.* **42** (1935), pp. 254-7.

Continuous operation is replacing batch operation wherever possible in process work because of reduced labor costs and more uniform products. The fact, however, has not ordinarily been recognized that it may result in decreased capacity per unit volume of apparatus. An exact method of predicting the amount of short-circuiting of materials passing through either single mixing tanks or a number of mixing tanks in series is needed. The problem of short-circuiting in continuous flow systems becomes acute whenever there is departure from streamline motion, and it is not easy to streamline a common mixing tank. The authors' study was limited to a consideration of a series of tanks in each of which there is adequate mixing. The presentation is mathematical and not subject to abstracting, but it may be found valuable for the solution of problems of this kind. Several useful diagrams are included.

Cracking Velocity and Heat of Reaction in Cracking. E. L. LEDERER. *Petroleum Zeitschrift* **31** (1935), No. 12, p. 1.

The velocity of cracking can be defined as the reciprocal of the time required to establish a defined equilibrium. This limit yield is properly selected as marking the equilibrium state inasmuch as it is independent of temperature to a great extent. The molecular heat of the cracking reaction is found to be 67,000 cal. per mol. As the value of C the equation $\log k = \frac{-q}{RT} + C$ is found to be 19,230. Using these values it was found possible to calculate the temperature required to give the limit yield of gasoline. The values so calculated closely check experimental values. If the half-life period of cracking is understood as the time at which half of the limit yield of gasoline is reached, this time $t = 0.301/k$, where k is the velocity constant. Calculations were made and are presented in tabular form showing that the calculated and experimentally found yields agree closely. Cracking is endothermic. The molecular cohesion for a hydrocarbon of 400 molecular weight is 30,000 cal. The heat of reaction is double this figure, from which it may be concluded that each molecule splits once and each cleavage product then splits once. It can be assumed that the heat of cracking reaction is approximately double the molecular cohesion or one and one-half times the heat of sublimation.

Cracking of Narrow Cuts. L. A. ALEKSANDROV. *Neftyanoe Khozyaistvo*, **26** (1934), No. 9, pp. 57-59.

It is stated that a higher gasoline yield may be obtained when cracking narrow cuts under different conditions for every cut, by raising the cracking temperature and durations of cracking for lower boiling fractions, and lowering the temperature and duration for heavier fractions, permitting an operation with insignificant coke formation. A number of experiments are described and the results are tabulated.

—Abs. from For. Pet. Tech., May, 1935

Light Cracking of Heavy Raw Material. YA. BLYAKHER, S. OBRYADCHIKOV, E. SMIDOVICH AND S. KHAIMAN. *Neftyanoe Khozyaistvo*, **26** (1934), No. 9, pp. 51-54.

A viscous crude oil stripped of light fractions and subjected to a preliminary light cracking at pressures of up to 25 atm., yielded 100% more gasoline on cracking than would have been obtained on cracking the above raw material without the preliminary "reducing". It is stated that the "reducing" causes the cracking of the heavy fractions without an excessive formation of C, which is also low when cracking this precracked material in the usual man-

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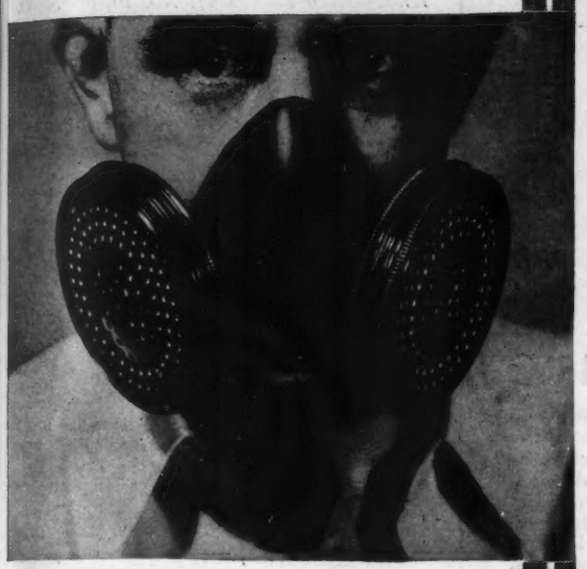

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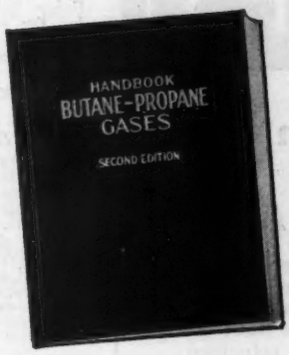

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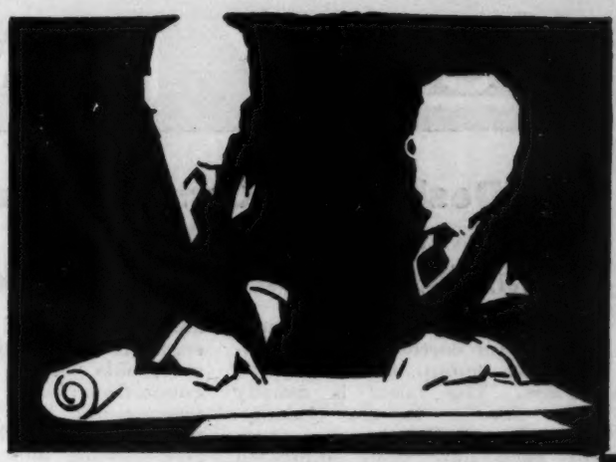

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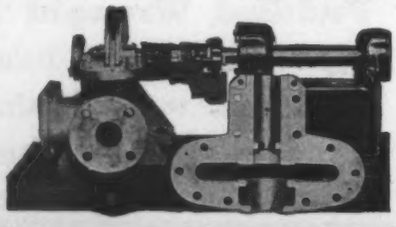

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ner. The individual fractions before and after cracking were vacuum distilled (tables and diagrams are given), and confirmed the above statement. The procedure is described in detail.

—Abs. from For. Pet. Tech., May, 1935

The Influence of Catalysts in the Vapor Phase Cracking. P. P. BORISOV AND M. B. GAVERDOVSKAYA. *Neftyanoe Khozyaistvo* **26** (1934), No. 10, pp. 37-40.

The cracking experiments were carried out in a Heraeus furnace at 500°C., a feeding velocity of one cc. per minute with a gas oil fraction of $d_{20}^{15} = 0.887$ b. 300-400°C., a kerosene fraction freed of aromatics and unsaturates b. 200-300°C., and synthetic compounds hexane, hexamethylene, methylhexamethylene and dimethyl-hexamethylene, in the absence and presence of catalysts (ZnO, Ni on Al_2O_3, activated C, Ni_2O_3, Al_2O_3, $Na_2B_4O_7$ (fused), glass chips, MnO_2, TiO_2, Ni wire, U-oxide, UO_3, activated bone C and ThO_2O. The gas oil yielded without catalysts 18.2%, and with Ni_2O_3 38.0% (highest yield) gasoline, the kerosene produced without catalyst 7.8, and with UO_3 26.4% gasoline (highest yield with activated C 33.8%), while methylcyclohexane and dimethylcyclohexane were decomposed into aromatic hexamethylene hydrocarbons on being cracked in the presence of UO_3. The gasoline obtained with U-oxide and UO_3 contained up to 48.7 and 48.2% respectively aromatics. UO_3 could be used repeatedly without any noticeable deterioration. Data on gasoline, kerosene and gas composition and yields obtained with various catalysts are tabulated.

—Abs. from For. Pet. Tech., May, 1935

Solvents. H. C. HOLDEN AND A. K. DOOLITTLE. *Ind. Eng. Chem.* **27** (1935), pp. 525-30.

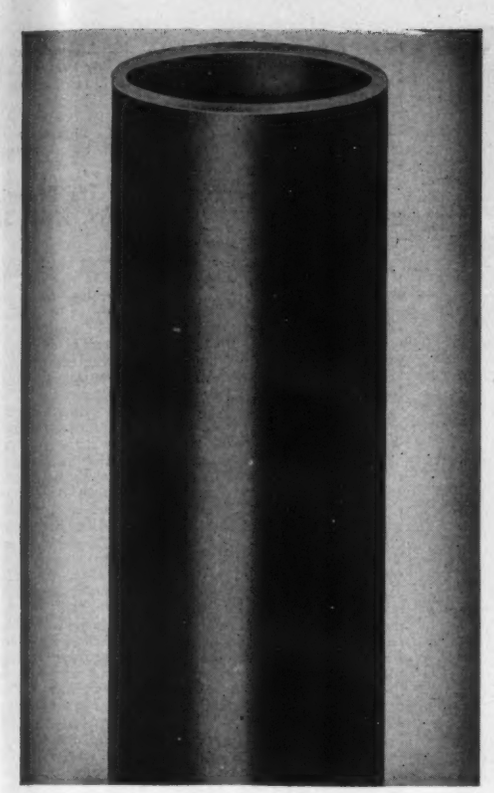
The development and present status of the American solvent industry is reviewed. Solvents considered are turpentine, ethyl alcohol, wood alcohol, acetone, butyl alcohol, and similar products. The uses of solvents in the paint, varnishes and lacquer industries, as anti-freeze solutions in automobile radiators, in the plastic, adhesive, artificial fabric and artificial silk industries, in the automobile industry, in the textile industry, and in the petroleum industry, are discussed. Chlorinated hydrocarbons are used in dissolving tetra-ethyl lead to make ethyl fluid. Solvents are now coming into wide use for the selective extraction of lubricating oils. Recently solvent dewaxing has begun to make rapid progress.

Solvent Extraction in Petroleum Refining. J. T. WARD AND H. O. FORREST. *Chem. & Met. Eng.* **42** (1935), pp. 246-50.

The subject of solvent extraction of petroleum oils is reviewed. Oils may contain substances groupable into the classes of asphaltenes, carbogens, naphthenes, parathenes, and paraffins. Solvents are now used both to change the properties of lubricating oils and to remove wax from oils. The general principle of solvent extraction is discussed and diagrammatically illustrated. A packed tower for counter-current extraction is described and several well known methods for changing the properties of the extract oil are noted, including recycling of extract, changing of temperature, or the addition of a third component that forms an upper layer of the more paraffinic components in the extracted oil. It is noted that the solvent should not be permitted to leave the system in equilibrium with the feed oil, but rather in equilibrium with a more naphthenic material. The use of propane in connection with extraction processes is discussed.

The Cause of the Bleaching Action of Bleaching Earths. E. ERDHEIM AND O. SCHNEIDER. *Petroleum, Zeitschrift, etc.* **31** (1935), No. 16, p. 1.

A study of the action of Fuller's earth, bentonite, and English bleaching earth, Montana B, and Montana Z, was made using gasoline that had acquired a deep yellow color through standing two years in colored glass flasks. A decolorizing carbon black, No. 2 Nuchar, was also used for comparison. After use, bleaching materials were each heated with 30 cc. of 95% alcohol under reflux for 20 minutes. The materials were collected on filters, dried and compared as to color with the original materials. The color of the extracting alcohol was also determined. It was found that the weakly decolorizing agents, such as Fuller's earth and bentonite, gave up very little of the adsorbed color to the alcohol. The English bleaching earth yielded more and the two Montana earths



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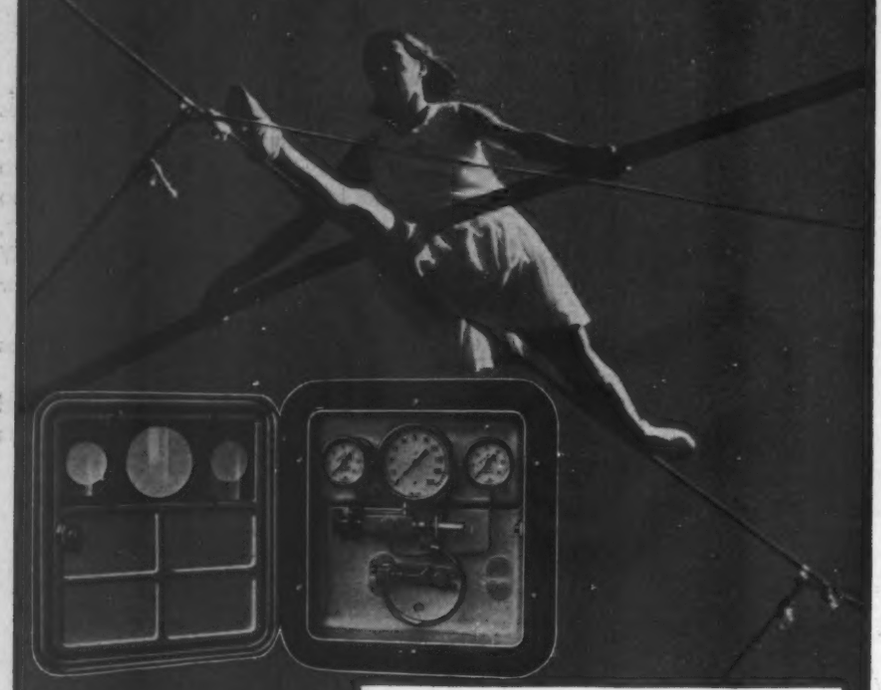

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large quantities. The poor decolorizers were restored to their original color by the alcohol extraction, but the two Montana earths changed from their original white color to a grayish rose. Adsorption by the English earth, the Montana earths, and the active carbon were found to conform to Freundlich's adsorption equation.

A Case of Corrosion and Its Investigation. K. WEISSELBERG. *Pet. Zeits.* 31 (1935), No. 10, p. 7.

Corrosion by sulfur is not necessarily proportionate to the amount of sulfur in the oil. If the oil contains sulfur compounds that are easily decomposed, it may be more corrosive than another oil containing more sulfur but with the sulfur in the form of more stable compounds. Sulfur corrosion was investigated in a battery of stills handling Roumanian paraffin-base crude oil having a sulfur content of 0.180%. Sulfur corrosion was strongest in the condenser tubes of the third, fourth and fifth stills. On the upper side of the tubes in the higher parts of the condenser the metal corroded rapidly. The tubes were fissured and scales of a brown combustible material formed that was found to be a mixture of iron sulfide, iron oxide, elementary sulfur and a little iron chloride. A sensitive process for establishing the presence of sulfur in metals was used. The metal to be tested was washed free of grease and a piece of bromide gelatin paper saturated with acid sublimate solution was laid on the metal and held there for a few minutes. It was then washed and dried and touched with a solution of iodine azide. The appearance of bubbles of nitrogen proved that sulfide was present on the metal where the paper was held. This test is also useful for detecting corrosive sulfur in motor fuels. Organic peroxides, especially cracked gasolines, react with mercury to give a black color but they do not give the iodine azide reaction. The test can be applied to motor fuels by shaking 6 to 8 cc. of the gasoline with a drop of mercury. The gasoline is then poured off and the mercury droplets washed with sulfur-free ether and placed in a watch glass. The ether is volatilized and iodine azide solution is poured over the mercury. If sulfur is present, bubbles of nitrogen will be evolved.

Paraffin - Impregnated Wood. J. WIERTELAK AND J. CZARNECKI. *Ind. Eng. Chem.* **27** (1935), pp. 543-47.

The authors point out that wood is a cheap and valuable construction material because of its strength, lightness and working properties. Its hygroscopicity is perhaps its chief disadvantage. Ordinarily it is protected with oil or coated with paint, lacquer or tar products. It can be rendered far more valuable by impregnation with paraffin wax. The procedure used in the experimental studies is described. Wood shrinks slightly when impregnated with wax. Wood impregnated with wax when immersed in water or in sulfuric acid solution absorbs the liquid and swells. The experiments indicate that the impregnation with paraffin wax does not therefore protect wood from moisture nor from the action of sulfuric acid at various concentrations, especially if the action of the liquid lasts for a long time. However, the presence of the wax lessens the soaking of liquid into the wood. Consequently all secondary phenomena such as swelling, production of acetic acid, reduction of surface hardness, and so on, are slowed down. Preliminary experiments indicate that a surface coating of paraffin yields better protection from moisture and acids than impregnation, provided the coating is not marred by cracks or lesions. Impregnation with wax increases the surface hardness of wood, and this is of importance in connection with the manufacture of flooring.

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Products: Properties and Utilization

Method for Predicting the Knocking Action of Fuels. M. BRUTZKUS. *Nov. Brennstoff-Chemie* **16** (1935), p. 94.

In 1930 Rice suggested that the thermal decomposition of the hydrocarbon molecule before oxidation was the cause of knock during combustion. These decompositions absorb heat, so that the increase in pressure resulting from the increase in number of molecules is counterbalanced by lowering the temperature of the mixture. The author believes that the change in the number of molecules during combustion is so important that a conclusion can be drawn as to the knocking behavior of a hydrocarbon from its constitutional formula. If the compound contains hydroxyl, methyl or amino radicals it is assumed that these split off to form water, methane, or ammonia respectively, and that the residue only is to be considered for

the change in number of molecules by oxidation. The substance shows a greater tendency to knock as the change in number of molecules is greater, expressed as per cent of the unburned mixture. A table for a large number of compounds shows parallelism between the values so calculated and the octane numbers or aniline valves of the substances.

Paraffin Wax. W. F. SEYER AND K. INOUYE. *Ind. Eng. Chem.* **27** (1935), pp. 167-70.

Solids are divided into two classes: plastic solids that are continuously deformed by a very small shearing stress; and crystalline solids, the deformation of which stops increasing after a time. Paraffin wax is a true solid, whereas sealing wax is a plastic solid or really a viscous liquid. However, there is a temperature limit above which paraffin wax behaves like a liquid. For wax of 55°C. melting point this temperature is 30°C. The tensile or breaking strength of commercial paraffin wax was investigated at temperatures between —10 and 30°C. It was found to vary considerably with the temperature, reaching a maximum value of 12 kilograms per square centimeter at 3°C. The density of the wax was measured over the same temperature range. There appeared to be no direct linear relationship between the two quantities. The apparatus used in the experiments is described and data are presented in detail.

Insecticides and Fungicides. R. C. ROARK. *Ind. Eng. Chem.* **27** (1935), pp. 330-32.

The production and uses of insecticides and fungicides are reviewed. This general subject is of interest to those in the petroleum industry because of the use of several million gallons of refined kerosene in the manufacture of fly sprays, and of heavier oils in the compounding of orchard and cattle sprays. An insecticide of growing importance is rotenone. This is highly toxic to lower forms of life but relatively nontoxic to higher forms of life, especially mammals. The probability of the replacement of the widely used inorganic insecticides by synthetic organic insecticides is stressed.

The Lubrication of Automobile Transmissions. E. GRAF SODEN FRAUNHOFEN. *Automobiltech. Z.* **37** (1934), pp. 503-7.

A testing machine for compounded lubricants is described. It comprises two pairs of gears and two long shafts. One of the shafts is divided, and by twisting both parts against each other the two pairs are put under artificial load. The apparatus is driven by an electric motor, and the frictional loss is determined by the torque of the motor. The material to be tested is placed in one of two boxes which contains a hardened and an unhardened gear. It was found that the load to which some extreme pressure lubricants can be subjected is increased by the addition of chemically active substances such as sulfur or carbon tetrachloride. It was confirmed that oleic acid has a favorable effect. Sodium soaps produce noise and leakage loss, but also reduce the lubricating value. Calcium, lead and aluminum soaps reduce noise less than sodium soaps. Rubber latex was found to be valuable, and colloidal graphite was also useful.

Toronto Method of Reclaiming Oil. W. R. MCRAE. *Elec. Traction and Bus J.* 31 (1935), p. 9.

The Toronto Transportation Commission annually reclaims approximately 10,000 gallons of crankcase oil from buses, as well as street car journal oil. The treatment comprises the use of activated clay and heating to 650°F. From 375° to 650°F. the oil is intermittently stirred with steam, and then quickly cooled to 400°F. and filtered. Heating is done by electrical immersion heaters using off-peak power. The cost of reclaiming the oil is slightly more than one-third the cost of new oil. Dirty motor oil and journal oil is heated and extracted centrifugally. It is then steamed and filtered at 450°F.

Chemical and Economical Considerations on Reclaiming Used Oil. ERNST W. STEINITZ. *Metallborse* **24** (1934), pp. 1419, 1450-1.

Steam-cylinder oils are little changed by use except that they become contaminated with water and contain small quantities of metal particles. Filtration and removal of water render the oil suitable for further use. Oils used in transmission bearings are replaced semiannually. They are sometimes reclaimed by centrifuging. Cutting oils are recovered from the ships, unchanged, by centrifuging. The extent

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of repurifying greases is high because they become contaminated with dust and dirt. Oil used in Diesel engines is thickened by a colloidal sludge. A plant for purifying such oils is briefly described. It consists of filtration, distillation, acid washing, neutralization and final filtration. This plant has a capacity of 200 tons per month.

A Standardized Test of Gasoline Color Stability. C. D. LOWRY, M. A. SMITH, AND G. B. MURPHY. *Ind. Eng. Chem., Anal. Ed.* **7** (1935), pp. 140-3.

The authors note the disadvantages of sunlight exposure tests for determining the light stability of gasoline even when controlled by some form of actinometer. A test has been devised using a plain type carbon arc, type C3A of the National Carbon Company. This source of light is preferred because of its uniformity and because of all artificial illuminates tested, it is nearest to sunlight in character. The arc used was fitted with the so-called "sunshine carbon", a cored carbon containing cerium, that gives a light similar to sunlight and that has a practically continuous spectrum from 2800 A. through the longer wave lengths. The main difference between carbon arcs and sunlight is the presence of a greater amount of short ultraviolet light in the arc spectrum. The details of the apparatus and the method of procedure are described. It was found that in the latitude of Chicago 40 minutes exposure at 1 foot distance from the arc was equivalent in change in color to a 2 hour exposure to the brightest summer sun. For routine work it is suggested that accurate results can be obtained by using an exposure of 15 minutes in a quartz container or 25 minutes in one of Corex D. The test has been in use for three years and has proved to be rapid and reproducible.

Ostwald Viscometers for Petroleum Oils. E. WILLIHNGANZ. *Physics,* **6** (1934), p. 61.

The design of viscometers of the Ostwald type has been reviewed by Barr. Considering his criticism of the normal type of Ostwald viscometer two instruments were designed for determining the viscosity of mineral oil. These instruments are believed to be free from the objection to the normal type. The instruments are described as well as the tests used in calibrating them. An equation is given for determining the viscometer constant at temperatures other than the temperature of calibration. It was found that when a working volume of 2.5 cc. is used, the viscometers designed for viscous oils do not need a drainage correction, although the viscometer designed for the lighter oils does need such a correction. This finding was checked with a large number of viscometers and no exception was found. The Ostwald viscometers have a time of flow proportional to the kinematic viscosity when used with petroleum oils of viscosity varying from 2.17 to 1280 centistokes.

Solutions for Colorimetric Standards. VI. M. G. MELLON AND C. T. KASLINE. *Ind. Eng. Chem., Anal. Ed.* **7** (1935), pp. 187-9.

The authors have studied ferric chloride solutions as a colorimetric standard. A new photoelectric spectrophotometer built by the General Electric Company in accordance with the design of Hardy was used. This equipment is briefly described. The effect of acid concentration on the ferric chloride standard is reviewed and discussed. It was found that the best range of concentration is probably from 0.5 to 0.02 mols ferric chloride and from 5.0 to 0.05 mols hydrochloric acid. A bibliography of the subject is included.

Contribution to the Determination of the Freezing Point of Paraffinic Crude Petroleums and Fuel Oils. L. CODARCEA. *Ann. mines Roumanie* **17** (1934), pp. 131-3, 183-7.

Freezing or solidification of crude petroleum showed no sharp transition from liquid to solid and occurs at no definite temperature. Paraffinic oils such as crude and fuel oils are really unsaturated solutions of paraffin. Upon cooling, crystals of paraffin first appear, following this complete solidification of a eutectic. The temperature at which solidification occurs can be affected by preliminary heating of the sample, which results in supersaturation with paraffin upon cooling. This can be partially counteracted by stirring. It is also affected by the rate of cooling. Before a determination of freezing point is made, the sample should be kept at 0° for 3 hours for crude oils, or 6 hours for fuel oils. It should not be heated before testing to a temperature higher than prescribed. The oil should not be stirred during the cooling period.

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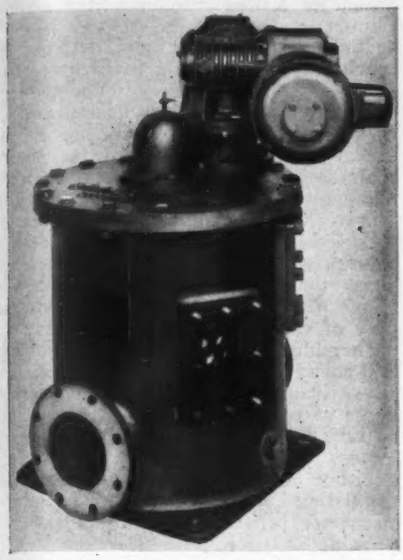

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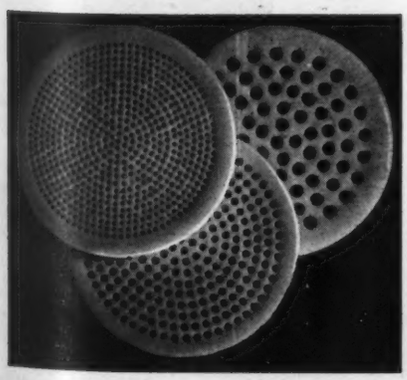

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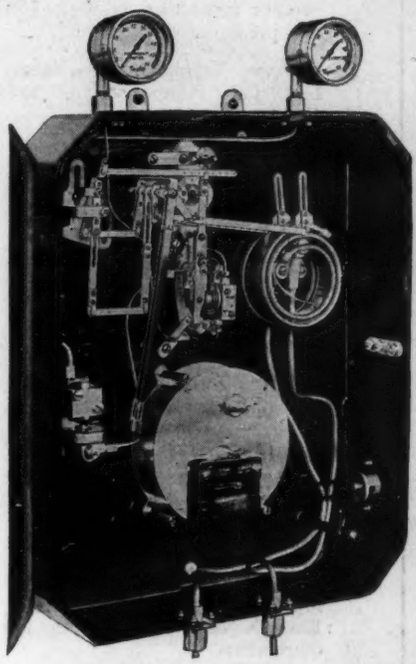

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Direct ratio adjustments cause an increase in the controlled condition when the adjusting condition increases, and vice versa.

Inverse ratio adjustments provide for a decrease in the controlled condition with an increase in the adjusting condition and vice versa.

Taylor Reset Controllers for temperature applications may be mercury-, vapor-, or gas-actuated, whichever is best adapted to the control problem. The chart is rotated by an electrically-driven clock movement; spring-driven clocks also are available.

Gate Valve

THE LUKENHEIMER COMPANY

The Lunkenheimer Company, Cincinnati, Ohio, has developed and placed on the market a new line of "Causul" metal gate valves for corrosive service. They

Lunkenheimer Valve

are especially recommended for handling sour crudes, gasoline, caustics and other troublesome liquids and gases. The new valve is an austenitic ferrous alloy and is particularly resistant to corrosion, the manufacturer claims.

Dial Thermometer

CONSOLIDATED ASHCROFT HANCOCK COMPANY

Consolidated Ashcroft Hancock Company, American Schaeffer & Budenberg Division, Bridgeport, Conn., announces its American Dial Thermometer, Type 603, in a phenol condensate case. Type 603 is made for measuring any temperatures within a range of —40° to 1000°F. The instrument is of mercury actuated type and is supplied for use in water, air, brine, gas, etc. The standard length of connecting tubing is five feet, and the maximum that can be furnished is ordinarily 50 feet, longer tubing requiring the use of a special compensating device.

Compressors

INGERSOLL-RAND COMPANY

The Ingersoll-Rand Company, 11 Broadway, New York, announces its steam driven compressor (Type XPV), which is a new machine in everything but name.

Boiler plants seldom are designed primarily to furnish steam for reciprocating-engine-driven machinery. On the contrary, the steam-driven compressor is usually chosen to fit into the existing steam-plant conditions with a view to maintaining the proper steam balance of the plant as a whole. For this reason the "Type XPV" compressor has been developed around a standardized set of frames and running gears. For each of these there has been developed a wide range of sizes of steam cylinders to take care of varying steam requirements.

In addition to the standard two-stage, 100-pound compressing end for each of these frames, a wide range of sizes and types of compressor cylinders is available to take care of special compressing problems.

Many combinations of governing and regulating equipment have been developed to insure proper regulation under every possible set of conditions.

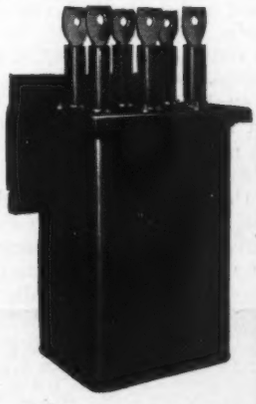
Although many recent developments in design have been embodied in the "Type XPV" compressor, all of the fundamental mechanical principles have been retained.

New features incorporated for the first time include: a box-girder-type frame, bored crosshead guides cast integral with the frame, "Double-crosshead and tie-rod" construction to give a straight-line drive from steam to compressor ends, new type governor, and pressure lubrication.

Oil Blast Circuit Breaker

GENERAL ELECTRIC COMPANY

General Electric Company, Schenectady, New York, announces an oil blast circuit breaker especially applicable where space is limited, such as in industrial plants and other stations. Designated as Type FK-42, it is rated 600 amperes, 7500 volts; 800 amperes, 2500 volts; and 25,000-kv-a. in-



GE Oil Blast Circuit Breaker

terrupting rating. All designs are double- and triple-pole and single throw, with all poles in a single rectangular welded plate steel tank. Provision is made for mounting directly back of panels, or in switch houses or metal-enclosed switchgear. They may be manually or electrically operated.

Features of the new FK-42 breaker include: Compact construction; silver-to-silver main contacts protected by arcing contacts, providing long life and low maintenance; oil blast baffles assuring high

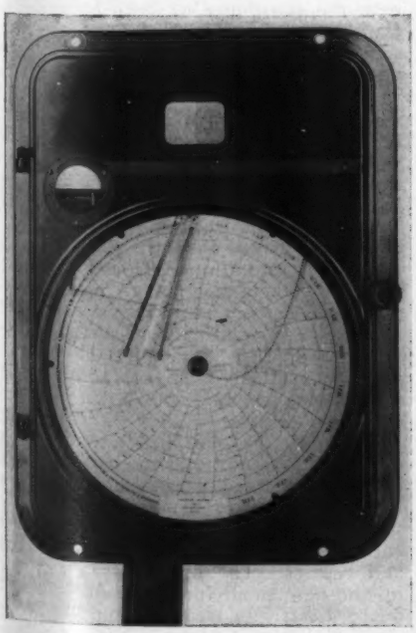
speed interruption with short arcs and minimum oil deterioration; sturdy Herkolite bushings giving high mechanical and dielectric strength; single tank for all poles, saving time during inspection and giving compact, space-saving construction; frame and tank completely fabricated of plate metal, with all joints electrically welded; internal mechanism with entire absence of external moving parts, increasing clearance and facilitating connections; and simple and positive internal mechanism construction, assuring long life, ease of maintenance, and high speed operation.

Flow Meter

THE BRISTOL COMPANY

The Bristol Company, Waterbury, Conn., announces a new flow meter employing the orifice and mercury manometer system of flow measurement, which is claimed to meet the needs of industry for a rugged, accurate and reasonably-priced mechanical flow meter. It is designed to give precision measurement under severe field conditions. According to the manufacturer, the following features are to be noted: Meter body is of forged steel. Uniform areas of cross-section in mercury chambers contribute to accuracy and interchangeability. Small changes in mercury volume incidental to capillarity and adhesion do not affect accuracy. The long float lever arm connecting the large powerful float to the pen arm assures both hair-line sensitivity without jumping and sustained accuracy. Connections are welded or mechanical. Parts are counter-balanced. Working parts permit cleaning without danger of disturbing calibration. Hardened stainless steel stuffing box is lapped to the shaft. Grease-packed, it is absolutely leak-tight. Neither glands nor packing washers are necessary. Different ranges of operation are made possible by changing either the size of the orifice, the high pressure leg of the manometer, or both.

Check valves, operating by gravity, prevent the loss of mercury. Meters for working pressures of 1000 pounds are tested at 2000 pounds. Special bodies tested at 5000 pounds are obtainable for working pressures up to 3000 pounds. The meters are available as indicators, integrators, recorders or controllers. Recorders can be furnished with pressure and temperature elements. Integrating flow meters are obtainable either with or without automatic compensation for fluctuations in static line pressure. They are suitable for use with either orifice plates or venturi tubes. With Bristol's Metameter, this new flow meter can be supplied as an electric flow meter for remote reading.

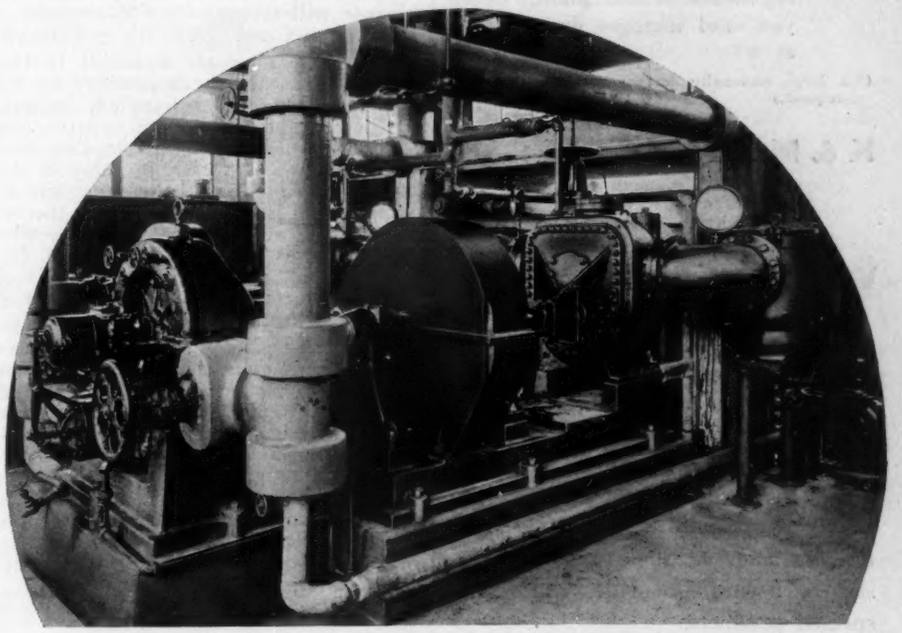


Bristol Flow Meter

Invisible Glove

E. I. du PONT de NEMOURS & CO.

E. I. du Pont de Nemours & Company, Wilmington, Del., Finishes Division, has perfected a new vanishing cream which forms an invisible glove, protecting the skin against dirt, paint, and grease. The new product, which is known as Pro-Tek, is not a soap but a cream compounded primarily for protection, and it is claimed to be entirely harmless and non-irritating to the skin. The cream, when rubbed on the hands, apparently disappears, leaving them dry and free from any feeling of stiffness or greasiness. It is being widely adopted by plant physicians and executives



When you buy Kinneys
you buy guaranteed results

Kinney Pumps have always been sold on a basis of actual capacity under specified operating conditions—not on their theoretical displacement. This method of rating pumps applies to the various types of Kinney Pumps, five of which are illustrated in Bulletins 10 and 11.

Accordingly, when specifying Kinneys you should state the actual quantity of liquid to be pumped and not increase it by 20% or 30%, unless an excess quantity can be handled without interfering with other processes.

For twenty-four hour day service every day in the year Kinney quality pumps will prove a good investment. Give us complete details of your pumping conditions and we will recommend from the five types available—HQ-A and HQ-G with external bearings; SD, HP and HQ-B with internal bearings—the design best suited for your requirements, and send bulletins. Address the nearest office.

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LOS ANGELES: 1333 Santa Fe Avenue

A "Complaint" that Sells K & M Products

VOICE ON PHONE:

This is the————Company.* We have one of your damper regulators in our plant. Could you send someone over to look at it?

(* a large nationally known concern, name on request.)

K & M SERVICE DEPT.

Certainly. What seems to be the matter with it?

VOICE ON PHONE:

Well, nothing serious. It's only that we've had it in operation *thirty-five years* now and feel it ought to be looked over.

No end of K & M Products have been giving this type of dependable service. Thirty years—thirty-five years—it's all the same to these skillfully designed, accurately made, rigidly inspected products.

It will pay you to investigate this long established and dependable line. A letter outlining your special problems will bring a prompt reply. Or write for bulletins on the particular K & M Product in which you are interested.

KIELEY & MUELLER, Inc.

34 West 13th St., New York, N. Y.

***Plant:* NEWARK, N. J.**

K and M

PRESSURE AND FLOW CONTROL APPARATUS

Steam Traps . . . Pump Governors . . . Back Pressure Valves . . . Pressure Regulating Valves . . . Air Pilot Operated Valves . . . Balanced Valves . . . Liquid Level Controllers.

for use by mechanics and factory workers, and is also filling a need for painters, printers, garage mechanics, service station men, pipe fitters, engineers, laboratory workers and others. All of the dirt and grime can be washed away with running water. Pro-Tek is being offered as one of the No. 7 Line products, through drug stores, service stations, auto accessory dealers, hardware and paint stores.

Scrubber

FLUOR CORPORATION

The Fluor Corporation, 909 East 59th St., Los Angeles, Calif., announces a new simple, positive and economical type of gas cleaner or scrubber. It is claimed by the manufacturers that this cleaner will remove over 99 percent of the moisture and dirt in the gas stream.

These cleaners are available in two types. Sizes are predetermined by the volume of gas to be handled. Because of their simple, fool-proof construction and freedom of moving parts, they may be operated 24 hours a day, day in and day out. Fluor gas cleaners require no attention or service other than the removal of water or dust which settles in the lower compartment. The frequency with which this is done is of course determined by the condition of the gas being cleaned.

The cleaner is low in cost; it has no complicated operating mechanism or movable parts to wear and be replaced. They can be furnished with different types of interior metal cones and screens, depending upon the characteristics of the gas being cleaned. The pressure drop in both the moisture and dust remover is small. There is a minimum amount of resistance to the passage of the gas from the time it enters the cleaner until it leaves.

Impact Wrench

INGERSOLL-RAND COMPANY.

Ingersoll-Rand Company, 11 Broadway, New York, N. Y., announces that the Pott impact wrench can now be furnished with a reversible mechanism, so that it can be used both for applying and removing nuts. The reversing is accomplished by shifting gears instead of reversing the air motor. This method was adopted because a non-reversible multi-vane motor uses about one third less air than a reversible motor of comparative size. It also prevents accidental reversing, thus adding to the safety of the wrench.

Another feature that has been added is the air cooling of the accumulator, which prevents overheating and results in much longer life.

This new wrench runs nuts on or off at a speed of approximately 600 to 700 r.p.m. and 1200 to 1400 impacts per minute, tightening or loosening.

As torque is applied to the accumulator (rubber) the twisting action shortens the rubber section, thus lifting the hammer from its seat. The energy stored in the accumulator drives the hammer forward so that it delivers a powerful rotary blow to the anvil, on the end of which is attached a chuck. These torsional impacts occurring at the rate of 1200 to 1400 per minute, exert a more powerful turning effect than is possible with any other portable wrench.

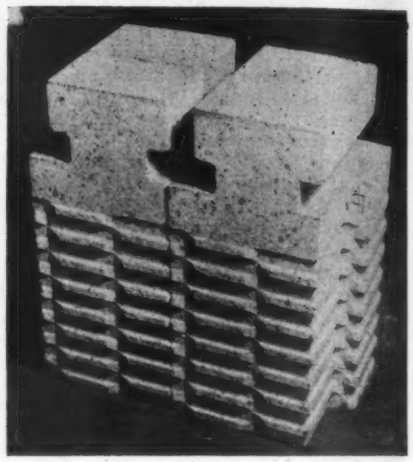
Refractory

M. H. DETRICK COMPANY

M. H. Detrick Company, 140 South Dearborn Street, Chicago, announces a new design of refractory for suspended arch and wall construction.

The new tile called "Detred" are approximately one half the size of the T-slotted tile and the faces of the tile are covered with corrugations or treads which mesh together with those on adjacent tile. The corrugations on the refractories themselves are so designed that the longitudinal joints in an arch and the vertical joints in a wall can be either straight line or offset.

One of the greatest sources of maintenance in furnace construction is the spalling of refractories. The new construction reduces spalling in two ways—first,



Detrick Refractory

by making the tile smaller, better molding and a more uniform burn through the interior of the tile is obtained; second, when spalls do take place, and they usually happen diagonally across the corner of a refractory, the spalls in individual tile are held in place by the corrugations on the adjoining tile and cannot fall out. Service has proven that this takes place effectively.

The intermeshed faces of the tile eliminate the possibility of furnace gases, or flames, working up through the refractory with a plus pressure condition and prevent air from leaking into the furnace in a draft condition. Instead of a flat sheet of fire clay or joint material that normally forms the joint in an arch or a wall, the joint in the improved construction takes the form of a waffle. The intermeshing treads on the adjoining tile form the waffle irons and the joint material is so locked in place that it cannot come loose or fall out. This is important, both from the standpoint of being an expansion cushion and from the standpoint of further preventing air leakage.

The staggered joints both in the arch and the wall eliminate the possibility of molten slag running along the joint and cutting it out. In arches with seemingly flat slopes, the slag has a tendency to cut along the joint and the service record of the perfected construction indicates that it is effective in eliminating this.

The tiles being of smaller size, are easier to handle and speed up installation and repairs. The brick mason can pick up the new small tile with one hand and put it directly in place without the necessity of sliding it along a bar, or adjusting an intermediate clip.

CATALOGS . . . BULLETINS

Helpful Publications Which Manufacturers Will Be Glad to Send Free for the Asking

Engineering Journal Revised

The Third Edition of the Timken Engineering Journal has just been issued by The Timken Roller Bearing Company, Canton, Ohio. Copies may be secured without charge by engineers, designers, libraries, and executives on request to the company. Requests should be made on company stationery, giving title or connection.

This 260-page journal, which is a series of 8½x11-inch loose leaves, bound in a heavy three-ring binder with stiff covers, has a 22-section marginal tab index for ready reference as well as the customary detailed index sheet.

The first four sections, comprising 46 pages, cover the design of Timken bearings with illustrations of the various types, a discussion of how they are rated, the curves and factors which apply for speed, life expectancy, engine torque, use or application, and 15 typical examples of how loads are calculated and bearings selected for various applications.

Following the tabular sections of the journal (50 pages), are the detailed dimension sheet sections (108 pages), preceded by a special index enabling the user to locate any bearing by series or number. Full and half-size illustrations suitable for tracing are given for all single row bearings and each sheet carries a table of ratings for the bearing shown for various speeds.

Complete data are available in the journal on Timken shims, locknut and washer assemblies, annular groove closures, tubes, etc., and a special section illustrates and describes typical methods of mounting Timken bearings, presenting also numerous suggestions as to effective closures.

The last two sections of the journal discuss cup and cone fitting practice for Timken bearings, giving definite recommendations, and cover also the subject of lubrication. Specifications for lubricants are given for a wide range of applications, together with a discussion of the use of the Timken lubricant tester.

This Third Edition of the Timken Engineering Journal includes 54 new standard Timken bearings and a new series of six heavy duty thrust bearings. Eight new cups have been listed, two new annular ring closures, and 12 new tubes. Numerous other minor changes in bearing construction, tolerances, etc., have been made in the body of the book and certain revisions made in the drawings to bring them up to date.

Tubing

Summerill Tubing Company, Bridgeport, Pennsylvania, has published a well illustrated 56-page catalog describing its complete line of tubing of all types for all industries. Catalog includes several pages of tabular engineering information of interest and value.

Electrical Equipment

General Electric Company, Schenectady, N. Y., is distributing Bulletin GEA 2127 describing its types Lp-1 and LP-Y1- Knife type switches and Bulletin GEA 1972, describing its type FK-144 A- high speed, oil-tight circuit breaker for 50,000 Kv-a service.

Evaporators

Goslin-Birmingham Manufacturing Company, Birmingham, Ala., has published a new bulletin dealing with its horizontal tube, vertical tube rapid circulation, and other types of evaporators, also surface and barometric condensers and the Flick centrifugal "catchall."

Equipment

J. P. Devine Manufacturing Company, Mt. Vernon, Ill., is distributing a condensed general catalog No. 105 B- describing its complete line in brief form and including four pages of charts and tables which will prove of interest to engineers. In addition the company has issued its Petroleum Division Bulletin, well illustrated to indicate the variety and size of refinery equipment furnished by the company.

Pumps

Worthington Pump & Machinery Corporation, Harrison, New Jersey, has published Bulletin W-323-B3—dealing with Worthington self-priming centrifugal Monobloc pumping units.

Boilers

Combustion Engineering Company, Inc., 200 Madison Avenue, New York, has issued an eight-page catalog covering general specifications for a line of horizontal return tubular boilers. These were formerly known as Casey-Hedges and Walsh-Weidner unit, and name is now "CE" boiler.

Automatic Control Valves

Golden-Anderson Valve Specialty Company, Pittsburgh, has issued Catalog No. 25, which describes some of the various types of automatic control valves for use in steam and water service.

Recording Instruments

The Brown Instrument Company, Philadelphia, has issued a folder that tells of the advantages of using recording instruments in the boiler room.

Cutting Machine

American Chain Company (Andrew C. Campbell Division), Bridgeport, Conn., has ready for distribution a four-page folder which describes the Campbell horizontal wet abrasive cutting machine.

Centrifugal Pumps

Gardner-Denver Company, Quincy, Illinois, is distributing a bulletin dealing with its double suction centrifugal pumps, type D. E. F. and G. They are adaptable to practically any class of service, designed for any type of drive and the series covers all heads up to 300 feet. The same company's bulletin CP-11, gives similar full information on its line of side suction centrifugal pumps and includes detailed tables giving the rating in gallons per hour against total head in feet.

Steam Traps

W. H. Nicholson & Company, 203 Oregon Street, Wilkes-Barre, Pa., has prepared Bulletin 535 dealing with two new models of steam traps for industrial use. The bulletin is illustrated and contains all pertinent information.

Thermometer

American Schaeffer & Budenberg Division, Consolidated Ashcroft Hancock Company, Inc., Bridgeport, Conn., has issued Catalog 600, covering dial thermometers of various types.

Pump

The McCord Radiator & Manufacturing Company, Detroit, Michigan, has issued a new bulletin on its Type C chemical measuring pump, with rotary drive, ratchet drive or motor drive. The bulletin is illustrated and contains all data pertinent to the subject.

Special Steels

Allegheny Steel Company has issued a pamphlet for users of corrosion resistant steels covering fabrication properties. The corrosion resistant steels surveyed cover three groups: austenitic, martensitic, and ferritic. In brief manner various types of welding, shearing, forming, drawing, blanking, punching, machining, spinning and riveting are discussed with recommendations in each case.

Gas Engines

Worthington Pump & Machinery Corporation, Harrison, N. J., has prepared a catalog on gas engines. Special emphasis is placed upon the features of design and construction.

Wire Cloth

Newark Wire Cloth Company, 351 Verona Avenue, Newark, N. J., has published a folder containing data on typical weaves and meshes of wire cloth, sieves, filter cloth and strainers.

Safety Signs

Mine Safety Appliances Company, Pittsburgh, is distributing a folder showing in colors its line of steel and enamel signs for marking danger points in industrial plants.

Burners

Surface Combustion Corporation, Toledo, Ohio, has issued Bulletin No. Sc 67, on its standard burners and burning equipment, with discussion of combustion principles and illustrations showing a wide variety of uses.

Stills

Barnstead Still & Sterilizer Company, Inc., 2 Lanesville Terrace, Forest Hills, Boston, Mass., is distributing a folder on solvent recovery stills for use in reclaiming solvents used in processing. Typical uses are listed and illustrations show characteristic installations.

Berylium Copper

American Brass Company, Waterbury, Conn., in its publication, B-21, second edition, describing berylium copper, a heat treatable alloy. Data tables and illustrations supplement the text.

Plate Size Card

Lukens Steel Company, Coatesville, Pa., has issued a card showing sizes of sheared or flame-cut steel plates produced in its mills, as a guide to purchasers. It shows thicknesses up to 25 inches and widths up to 186 inches.

Furnace Linings

McLeod & Nery Company, Troy, New York, has issued catalog No. 235, dealing with furnace linings and arches, including information on design, installation, and service advantages for modern boiler furnaces. It is well illustrated with drawings showing methods of application.

Meters

General Electric Company, Schenectady, New York, has published a 56-page catalog giving detailed information on its demand meters, for measurement of maximum power demands and its allied problems. The line includes indicating, graphic and printing types for all classes of service.

Safety Information

Mine Safety Appliances Company, Braddock, Thomas and Meades Sts., Pittsburgh, has prepared "Carbon Monoxide, the Killer", which discusses the cause of the fourth largest group of occupational diseases, accidents and deaths. Equipment which may be used to prevent this hazard is described and illustrated.

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(Address manufacturer direct)

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Please send me, without obligation, free booklet described in July, 1935, issue of REFINER AND NATURAL GASOLINE MANUFACTURER.

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Modern Processes DEMAND Modern Equipment

Pacific, G.E. Motorized, Speed Reducer in plant of Associated Oil Co., Avon, Calif.

General Electric steam turbine in Cycol plant of Associated Oil Co., Avon, Calif.

WHEN special refining processes are required, modern machinery is essentially important to the success of the process. Associated Oil Company chose General Electric equipment for its Cycol lubricating-oil plant at Avon, California, because G-E motors and turbines could be relied on to give long, dependable, and uninterrupted service.

Consult General Electric for complete information on equipping your refinery or pumping station. Call the nearest G-E office or write to General Electric, Department 6B-201, Schenectady, N. Y.

020-139

GENERAL ELECTRIC

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